

BID PROPOSAL INSTRUCTIONS

ABOUT IDOT PROPOSALS: All proposals are potential bidding proposals. Each proposal contains all certifications and affidavits, a proposal signature sheet and a proposal bid bond.

PREQUALIFICATION

Any contractor who desires to become pre-qualified to bid on work advertised by IDOT must submit the properly completed pre-qualification forms to the Bureau of Construction no later than 4:30 p.m. prevailing time twenty-one days prior to the letting of interest. This pre-qualification requirement applies to first time contractors, contractors renewing expired ratings, contractors maintaining continuous pre-qualification or contractors requesting revised ratings. To be eligible to bid, existing pre-qualification ratings must be effective through the date of letting.

WHO CAN BID ?

Bids will be accepted from only those companies that request and receive written Authorization to Bid from IDOT's Central Bureau of Construction.

REQUESTS FOR AUTHORIZATION TO BID

Contractors wanting to bid on items included in a particular letting must submit the properly completed "Request for Authorization to Bid/or Not For Bid Status" (BDE 124) and the ORIGINAL "Affidavit of Availability" (BC 57) to the proper office no later than 4:30 p.m. prevailing time, three (3) days prior to the letting date.

WHAT CONSTITUTES WRITTEN AUTHORIZATION TO BID?

When a prospective prime bidder submits a "Request for Authorization to Bid/or Not For Bid Status"(BDE 124) he/she must indicate at that time which items are being requested For Bidding purposes. Only those items requested For Bidding will be analyzed. After the request has been analyzed, the bidder will be issued an **Authorization to Bid or Not for Bid Report**, approved by the Central Bureau of Construction and the Chief Procurement Officer that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Authorization to Bid or Not for Bid Report** will indicate the reason for denial.

ABOUT AUTHORIZATION TO BID

Firms that have not received an Authorization to Bid or Not For Bid Report within a reasonable time of complete and correct original document submittal should contact the Department as to the status. Firms unsure as to authorization status should call the Prequalification Section of the Bureau of Construction at the number listed at the end of these instructions.

ADDENDA AND REVISIONS

It is the bidder's responsibility to determine which, if any, addenda or revisions pertain to any project they may be bidding. Failure to incorporate all relevant addenda or revisions may cause the bid to be declared unacceptable.

Each addendum or revision will be included with the Electronic Plans and Proposals. Addenda and revisions will also be placed on the Addendum/Revision Checklist and each subscription service subscriber will be notified by e-mail of each addendum and revision issued.

The Internet is the Department's primary way of doing business. The subscription service emails are an added courtesy the Department provides. It is suggested that bidders check IDOT's website at <http://www.dot.il.gov/desenv/delett.html> before submitting final bid information.

IDOT IS NOT RESPONSIBLE FOR ANY E-MAIL FAILURES.

Addenda questions may be directed to the Contracts Office at (217)782-7806 or DOT.D&Econtracts@illinois.gov

Technical questions about downloading these files may be directed to Tim Garman at (217)524-1642 or Timothy.Garman@illinois.gov.

STANDARD GUIDELINES FOR SUBMITTING BIDS

- All pages should be single sided.
- Use the Cover Page that is provided in the Bid Proposal (posted on the IDOT Web Site) as the first page of your submitted bid. It has the item number in large bold type in the upper left-hand corner and lines provided for your company name and address in the upper right-hand corner.
- Do not use report covers, presentation folders or special bindings and do not staple multiple times on left side like a book. Use only 1 staple in the upper left hand corner. Make sure all elements of your bid are stapled together including the bid bond or guaranty check (if required).
- Do not include any certificates of eligibility, your authorization to bid, Addendum Letters or affidavit of availability.
- Do not include the Subcontractor Documentation with your bid (pages i – iii and pages a – g). This documentation is required only if you are awarded the project.
- Use the envelope cover sheet (provided with the proposal) as the cover for the proposal envelope.
- Do not rely on overnight services to deliver your proposal prior to 10 AM on letting day. It will not be read if it is delivered after 10 AM.
- Do not submit your Substance Abuse Prevention Program (SAPP) with your bid. If you are awarded the contract this form is to be submitted to the district engineer at the pre-construction conference.

BID SUBMITTAL CHECKLIST

- Cover page** (the sheet that has the item number on it) – This should be the first page of your bid proposal, **followed by your bid (the Schedule of Prices/Pay Items)**. If you are using special software or CBID to generate your schedule of prices, do not include the blank pages of the schedule of prices that came with the proposal package.
- Page 4 (Item 9)** – Check “YES” if you will use a subcontractor(s) with an annual value over \$50,000. Include the subcontractor(s) name, address, general type of work to be performed and the dollar amount. If you will use subcontractor(s) but are uncertain who or the dollar amount; check “YES” but leave the lines blank.
- After page 4** – Insert the following documents: The **Illinois Office Affidavit** (Not applicable to federally funded projects) followed by Cost Adjustments for Steel, Bituminous and Fuel (if applicable) and the Contractor Letter of Assent (if applicable). The general rule should be, if you don’t know where it goes, put it after page 4.
- Page 10 (Paragraph J)** – Check “YES” or “NO” whether your company has any business in Iran.
- Page 10 (Paragraph K)** – (Not applicable to federally funded projects) List the name of the apprenticeship and training program sponsor holding the certificate of registration from the US Department of Labor. If no applicable program exists, please indicate the work/job category **Your bid will not be read if this is not completed.** Do not include certificates with your bid. Keep the certificates in your office in case they are requested by IDOT.
- Page 11 (Paragraph L)** – A copy of your State Board of Elections certificate of registration is no longer required with your bid.
- Page 11 (Paragraph M)** – Indicate if your company has hired a lobbyist in connection with the job for which you are submitting the bid proposal.
- Page 12 (Paragraph C)** – This is a work sheet to determine if a completed Form A is required. It is not part of the form and you do not need to make copies for each completed Form A.
- Pages 14-17 (Form A)** – One Form A (4 pages) is required for each applicable person in your company. Copies of the forms can be used and only need to be changed when the information changes. The certification signature and date must be original for each letting. **Do not staple the forms together.** If you answered “NO” to all of the questions in Paragraph C (page 12), complete the first section (page 14) with your company information and then sign and date the Not Applicable statement on page 17.
- Page 18 (Form B)** - If you check “YES” to having other current or pending contracts it is acceptable to use the phrase, “See Affidavit of Availability on file”. **Ownership Certification** (at the bottom of the page) - Check N/A if the Form A(s) you submitted accounts for 100 percent of the company ownership. Check YES if any percentage of ownership falls outside of the parameters that require reporting on the Form A. Checking NO indicates that the Form A(s) you submitted is not correct and you will be required to submit a revised Form A.
- Page 20 (Workforce Projection)** – Be sure to include the Duration of the Project. It is acceptable to use the phrase “Per Contract Specifications”.

Proposal Bid Bond – (Insert after the proposal signature page) Submit your proposal Proposal Bid Bond (if applicable) using the current Proposal Bid Bond form provided in the proposal package. The Power of Attorney page should be stapled to the Proposal Bid Bond. If you are using an electronic bond, include your bid bond number on the Proposal Bid Bond and attach the Proof of Insurance printed from the Surety’s Web Site.

Disadvantaged Business Utilization Plan and/or Good Faith Effort – The last items in your bid should be the DBE Utilization Plan (SBE 2026), followed by the DBE Participation Statement (SBE 2025) and supporting paperwork. If you have documentation of a Good Faith Effort, it is to follow the SBE Forms.

The Bid Letting is now available in streaming Audio/Video from the IDOT Web Site. A link to the stream will be placed on the main page of the current letting on the day of the Letting. The stream will not begin until 10 AM. The actual reading of the bids does not begin until approximately 10:30 AM.

Following the Letting, the As-Read Tabulation of Bids will be posted by the end of the day. You will find the link on the main Web page for the current letting.

QUESTIONS: pre-letting up to execution of the contract

Contractor pre-qualification	217-782-3413
Small Business, Disadvantaged Business Enterprise (DBE)	217-785-4611
Contracts, Bids, Letting process or Internet downloads	217-782-7806
Estimates Unit.....	217-785-3483
Aeronautics.....	217-785-8515
IDNR (Land Reclamation, Water Resources, Natural Resources).....	217-782-6302

QUESTIONS: following contract execution

Subcontractor documentation, payments	217-782-3413
Railroad Insurance	217-785-0275

RETURN WITH BID

117

Proposal Submitted By
Name
Address
City

Letting February 28, 2014

NOTICE TO PROSPECTIVE BIDDERS

This proposal can be used for bidding purposes by only those companies that request and receive written AUTHORIZATION TO BID from IDOT's Central Bureau of Construction.

BIDDERS NEED NOT RETURN THE ENTIRE PROPOSAL

Notice to Bidders, Specifications, Proposal, Contract and Contract Bond



**Illinois Department
of Transportation**

Springfield, Illinois 62764

**Contract No. 60W29
COOK County
Section 2013-011R
Route FAI 290
Project ACNHPP-0290(200)
District 1 Construction Funds**

PLEASE MARK THE APPROPRIATE BOX BELOW:

- A Bid Bond is included.
- A Cashier's Check or a Certified Check is included
- An Annual Bid Bond is included or is on file with IDOT.

Prepared by

Checked by

F

(Printed by authority of the State of Illinois)

Page intentionally left blank

RETURN WITH BID



PROPOSAL

TO THE DEPARTMENT OF TRANSPORTATION

1. Proposal of _____

Taxpayer Identification Number (Mandatory) _____

For the improvement identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60W29
COOK County
Section 2013-011R
Project ACNHPP-0290(200)
Route FAI 290
District 1 Construction Funds**

Bridge replacement, roadway reconstruction, lighting and CTA station rehabilitation on Peoria Street Bridge (SN 016-1708) at I-290/Congress Parkway (Circle Interchange) located in Chicago.

2. The undersigned bidder will furnish all labor, material and equipment to complete the above described project in a good and workmanlike manner as provided in the contract documents provided by the Department of Transportation. This proposal will become part of the contract and the terms and conditions contained in the contract documents will govern performance and payments.

RETURN WITH BID

3. **ASSURANCE OF EXAMINATION AND INSPECTION/WAIVER.** The undersigned bidder further declares that he/she has carefully examined the proposal, plans, specifications, addenda form of contract and contract bond, and special provisions, and that he/she has inspected in detail the site of the proposed work, and that he/she has familiarized themselves with all of the local conditions affecting the contract and the detailed requirements of construction, and understands that in making this bid proposal he/she waives all right to plead any misunderstanding regarding the same.

4. **EXECUTION OF CONTRACT AND CONTRACT BOND.** The undersigned bidder further agrees to execute a contract for this work and present the same to the department within fifteen (15) days after the contract has been mailed to him/her. The undersigned further agrees that he/she and his/her surety will execute and present within fifteen (15) days after the contract has been mailed to him/her contract bond satisfactory to and in the form prescribed by the Department of Transportation, in the penal sum of the full amount of the contract, or as specified in the special provisions, guaranteeing the faithful performance of the work in accordance with the terms of the contract.

5. **PROPOSAL GUARANTY.** Accompanying this proposal is either a bid bond on the department form, executed by a corporate surety company satisfactory to the department, or a proposal guaranty check consisting of a bank cashier's check or a properly certified check for not less than 5 per cent of the amount bid or for the amount specified in the following schedule:

<u>Amount of Bid</u>		<u>Proposal Guaranty</u>		<u>Amount of Bid</u>		<u>Proposal Guaranty</u>	
Up to	\$5,000	\$150		\$2,000,000	to	\$3,000,000	\$100,000
\$5,000	to \$10,000	\$300		\$3,000,000	to	\$5,000,000	\$150,000
\$10,000	to \$50,000	\$1,000		\$5,000,000	to	\$7,500,000	\$250,000
\$50,000	to \$100,000	\$3,000		\$7,500,000	to	\$10,000,000	\$400,000
\$100,000	to \$150,000	\$5,000		\$10,000,000	to	\$15,000,000	\$500,000
\$150,000	to \$250,000	\$7,500		\$15,000,000	to	\$20,000,000	\$600,000
\$250,000	to \$500,000	\$12,500		\$20,000,000	to	\$25,000,000	\$700,000
\$500,000	to \$1,000,000	\$25,000		\$25,000,000	to	\$30,000,000	\$800,000
\$1,000,000	to \$1,500,000	\$50,000		\$30,000,000	to	\$35,000,000	\$900,000
\$1,500,000	to \$2,000,000	\$75,000		over		\$35,000,000	\$1,000,000

Bank cashier's checks or properly certified checks accompanying bid proposals will be made payable to the Treasurer, State of Illinois.

If a combination bid is submitted, the proposal guaranties which accompany the individual bid proposals making up the combination will be considered as also covering the combination bid.

The amount of the proposal guaranty check is _____ \$(_____). If this proposal is accepted and the undersigned will fail to execute a contract bond as required herein, it is hereby agreed that the amount of the proposal guaranty will become the property of the State of Illinois, and shall be considered as payment of damages due to delay and other causes suffered by the State because of the failure to execute said contract and contract bond; otherwise, the bid bond will become void or the proposal guaranty check will be returned to the undersigned.

Attach Cashier's Check or Certified Check Here

In the event that one proposal guaranty check is intended to cover two or more bid proposals, the amount must be equal to the sum of the proposal guaranties which would be required for each individual bid proposal. If the guaranty check is placed in another bid proposal, state below where it may be found.

The proposal guaranty check will be found in the bid proposal for:

Item _____

Section No. _____

County _____

Mark the proposal cover sheet as to the type of proposal guaranty submitted.

RETURN WITH BID

6. **COMBINATION BIDS.** The undersigned bidder further agrees that if awarded the contract for the sections contained in the following combination, he/she will perform the work in accordance with the requirements of each individual contract comprising the combination bid specified in the schedule below, and that the combination bid shall be prorated against each section in proportion to the bid submitted for the same. If an error is found to exist in the gross sum bid for one or more of the individual sections included in a combination, the combination bid shall be corrected as provided in the specifications.

When a combination bid is submitted, the schedule below must be completed in each proposal comprising the combination.

If alternate bids are submitted for one or more of the sections comprising the combination, a combination bid must be submitted for each alternate.

Schedule of Combination Bids

Combination No.	Sections Included in Combination	Combination Bid	
		Dollars	Cents

7. **SCHEDULE OF PRICES.** The undersigned bidder submits herewith, in accordance with the rules and instructions, a schedule of prices for the items of work for which bids are sought. The unit prices bid are in U.S. dollars and cents, and all extensions and summations have been made. The bidder understands that the quantities appearing in the bid schedule are approximate and are provided for the purpose of obtaining a gross sum for the comparison of bids. If there is an error in the extension of the unit prices, the unit prices will govern. Payment to the contractor awarded the contract will be made only for actual quantities of work performed and accepted or materials furnished according to the contract. The scheduled quantities of work to be done and materials to be furnished may be increased, decreased or omitted as provided elsewhere in the contract.

8. **AUTHORITY TO DO BUSINESS IN ILLINOIS.** Section 20-43 of the Illinois Procurement Code (the Code) (30 ILCS 500/20-43) provides that a person (other than an individual acting as a sole proprietor) must be a legal entity authorized to do business in the State of Illinois prior to submitting the bid.

9. **EXECUTION OF CONTRACT:** The Department of Transportation will, in accordance with the rules governing Department procurements, execute the contract and shall be the sole entity having the authority to accept performance and make payments under the contract. Execution of the contract by the Chief Procurement Officer (CPO) or the State Purchasing Officer (SPO) is for approval of the procurement process and execution of the contract by the Department. Neither the CPO nor the SPO shall be responsible for administration of the contract or determinations respecting performance or payment there under except as otherwise permitted in the Code.

10. **The services of a subcontractor will be used.**

Check box Yes
 Check box No

For known subcontractors with subcontracts with an annual value of more than \$50,000, the contract shall include their name, address, general type of work to be performed, and the dollar allocation for each subcontractor. (30 ILCS 500/20-120)

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
K0029634	WEED CONTR PRE-EM GRN	POUND	1.000				
K1003679	MULCH	CU YD	14.000				
X0322141	REM TEMP WOOD POLE	EACH	4.000				
X0322400	PILE EXTRACTION	EACH	77.000				
X0324198	REMOV ASB CEM CONDUIT	FOOT	885.000				
X0324571	MAINT ST LTG SYS CHGO	L SUM	1.000				
X0325207	TV INSPECT OF SEWER	FOOT	1,546.000				
X0325815	REMOVE EXISTING CABLE	FOOT	340.000				
X0326326	CC TPX 2-1/C6 1-1/CG	FOOT	1,115.000				
X0326382	CONC BARRIER BASE SPL	FOOT	467.000				
X0326486	DECORATIVE RAIL PR MT	FOOT	496.000				
X0326801	COMBND SEWR TO BE CLN	FOOT	453.000				
X0326935	CROSSHOLE SONIC LOG	EACH	4.000				
X0327004	TEMP WP 60 CL 4	EACH	4.000				
X0327357	CONSTRN VBRN MONITRNG	L SUM	1.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK - -

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0327614	COMB SEW REM 12	FOOT	4.000				
X0327615	COMB SEW REM 8	FOOT	85.000				
X0327616	MAINT ITS DURG CONSTR	CAL MO	15.000				
X0327649	SOIL RETENTION SYSTEM	SQ FT	104.000				
X0327685	COMB SEW REM 54	FOOT	95.000				
X0327687	SIPHON RECONSTRUCTION	L SUM	1.000				
X0327688	REM ETU BOLLARD FDN	EACH	2.000				
X0327689	COMB SEW CLEANED SPL	FOOT	930.000				
X0327690	TV INSPECT SEWER SPL	FOOT	1,860.000				
X0370049	UGRD C PVC2SCH80 CDOT	FOOT	635.000				
X0370069	COMB SEW ESVCP 8 CDOT	FOOT	110.000				
X0370070	COMB SEW WMR 8 CDOT	FOOT	30.000				
X0370074	RACKING CBL MH/HHCDOT	EACH	4.000				
X0370075	UGRD C PVC4SCH80 CDOT	FOOT	2,565.000				
X0370076	ROD/CL DCT COND CDOT	FOOT	160.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0370080	COMB C&G B V.12(CDOT)	FOOT	238.500				
X0370081	SAND CUSHION 4 (CDOT)	SQ FT	4,844.000				
X0370085	CLN MNHL/HNDHL (CDOT)	EACH	4.000				
X0370135	CONC CURB TB SPL CDOT	FOOT	807.600				
X0370185	COMB SEW ESVCP 12CDOT	FOOT	4.000				
X0370186	EL MH 3X4X4 30FL CDOT	EACH	2.000				
X0370187	CONCRETE (CTA)	L SUM	1.000				
X0370188	DEMOLITION CTA	L SUM	1.000				
X0370189	STR STL METAL DCK CTA	L SUM	1.000				
X0370191	ELEVATOR CTA	L SUM	1.000				
X0370192	MECH & PLUMBING CTA	L SUM	1.000				
X0370193	ELEC & COMM CTA	L SUM	1.000				
X0370195	RELOC DUCT BANK CTA	L SUM	1.000				
X0370196	BALLST TRCK CONST CTA	EACH	4.000				
X0370197	MAINT TRANS OPER CTA	L SUM	1.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK- -

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0370198	EXPLORATRY TRENCH CTA	FOOT	560.000				
X0370199	EARTHWK MP DS CTA	L SUM	1.000				
X0370200	STATION RENOVAT CTA	L SUM	1.000				
X0370201	U C PVC 3/4 S80 CDOT	FOOT	775.000				
X0539800	TREE GRATES	EACH	3.000				
X4240800	DETECTABLE WARN SPL	SQ FT	12.000				
X5011100	FOUNDATION REM	EACH	8.000				
X5040500	PREC CONC DECK PANELS	SQ FT	15,272.000				
X5091730	BRIDGE FENCE RAIL SP	FOOT	129.000				
X5537700	SS CLEANED 10	FOOT	176.000				
X5610712	WATER MAIN REMOV 12	FOOT	103.000				
X5860110	GRANULAR BACKFILL STR	CU YD	683.000				
X6020083	INLET TA T1FOL (CHGO)	EACH	1.000				
X6022505	CB TA 4D T1FOL (CHGO)	EACH	7.000				
X6022900	CB RECONST SPL	EACH	1.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK- -

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X6030310	FR & LIDS ADJUST SPL	EACH	3.000				
X6331110	STEEL POSTS SPECIAL	EACH	3.000				
X6370050	CONC BAR WALL SPL	FOOT	317.000				
X6370700	CONC BAR TRANS SPL	FOOT	150.000				
X6640200	TEMP CH LK FENCE	FOOT	1,075.000				
X6700410	ENGR FLD OFF A SPL	CAL MO	15.000				
X7010216	TRAF CONT & PROT SPL	L SUM	1.000				
X7011015	TR C-PROT EXPRESSWAYS	L SUM	1.000				
X7013820	TR CONT SURVEIL EXPWY	CAL DA	259.000				
X7035104	TEMP EPOXY PVT MK L4	FOOT	7,305.000				
X7035105	TEMP EPOXY PVT MK L5	FOOT	3,026.000				
X7035108	TEMP EPOXY PVT MK L8	FOOT	15,489.000				
X7035112	TEMP EPOXY PVT MK L12	FOOT	41.000				
X7360300	REM OH SIN STR-WLKWAY	FOOT	88.000				
X7830050	RAISD REF PM REFL REM	EACH	387.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X8360110	LIGHT POLE FDN SPL	FOOT	30.000				
X8780107	CONC FDN SPL	FOOT	12.000				
Z0004002	BOLLARDS	EACH	2.000				
Z0004552	APPROACH SLAB REM	SQ YD	184.000				
Z0005305	BOX CUL TO BE CLEANED	FOOT	144.000				
Z0006012	BR DK LTX C OLY 2 1/4	SQ YD	1,614.000				
Z0007120	WELD WIRE FAB 6X6	SQ YD	66.000				
Z0013302	SEGMENT CONC BLK WALL	SQ FT	50.000				
Z0013797	STAB CONSTR ENTRANCE	SQ YD	998.000				
Z0013798	CONSTRUCTION LAYOUT	L SUM	1.000				
Z0018002	DRAINAGE SCUPPR DS-11	EACH	2.000				
Z0018800	DRAINAGE SYSTEM	L SUM	1.000				
Z0022800	FENCE REMOVAL	FOOT	44.000				
Z0030850	TEMP INFO SIGNING	SQ FT	443.000				
Z0033028	MAINTAIN LIGHTING SYS	CAL MO	15.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK- -

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
Z0046304	P UNDR FOR STRUCT 4	FOOT	318.000				
Z0048665	RR PROT LIABILITY INS	L SUM	1.000				
Z0062456	TEMP PAVEMENT	SQ YD	849.000				
Z0073002	TEMP SOIL RETEN SYSTM	SQ FT	9,532.000				
Z0076600	TRAINEES	HOUR	2,500.000		0.800		2,000.000
Z0076604	TRAINEES TPG	HOUR	2,500.000		15.000		37,500.000
20100110	TREE REMOV 6-15	UNIT	1,230.000				
20101000	TEMPORARY FENCE	FOOT	226.000				
20101100	TREE TRUNK PROTECTION	EACH	24.000				
20101200	TREE ROOT PRUNING	EACH	24.000				
20101300	TREE PRUN 1-10	EACH	20.000				
20101350	TREE PRUN OVER 10	EACH	4.000				
20200100	EARTH EXCAVATION	CU YD	1,270.000				
20201200	REM & DISP UNS MATL	CU YD	520.000				
20400800	FURNISHED EXCAVATION	CU YD	1,300.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
20800150	TRENCH BACKFILL	CU YD	902.000				
21001000	GEOTECH FAB F/GR STAB	SQ YD	150.000				
21101615	TOPSOIL F & P 4	SQ YD	5,221.000				
21301052	EXPLOR TRENCH 52	FOOT	100.000				
25000210	SEEDING CL 2A	ACRE	0.250				
25000400	NITROGEN FERT NUTR	POUND	81.000				
25000600	POTASSIUM FERT NUTR	POUND	81.000				
25000750	MOWING	ACRE	0.250				
25100115	MULCH METHOD 2	ACRE	2.500				
25100135	MULCH METHOD 4	ACRE	0.750				
25100630	EROSION CONTR BLANKET	SQ YD	611.000				
25200110	SODDING SALT TOLERANT	SQ YD	4,610.000				
25200200	SUPPLE WATERING	UNIT	207.600				
28000250	TEMP EROS CONTR SEED	POUND	241.000				
28000400	PERIMETER EROS BAR	FOOT	2,163.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
28000510	INLET FILTERS	EACH	37.000				
30300001	AGG SUBGRADE IMPROVE	CU YD	50.000				
31101200	SUB GRAN MAT B 4	SQ YD	1,035.000				
31101400	SUB GRAN MAT B 6	SQ YD	1,448.000				
35300400	PCC BSE CSE 9	SQ YD	98.000				
35301200	HES PCC BSE CSE 9	SQ YD	10.000				
35501316	HMA BASE CSE 8	SQ YD	68.000				
40600200	BIT MATLS PR CT	TON	0.300				
40600300	AGG PR CT	TON	0.200				
40600982	HMA SURF REM BUTT JT	SQ YD	19.000				
40603085	HMA BC IL-19.0 N70	TON	34.000				
40603340	HMA SC "D" N70	TON	39.000				
42001200	PAVEMENT FABRIC	SQ YD	98.000				
42001300	PROTECTIVE COAT	SQ YD	133.000				
42001420	BR APPR PVT CON (PCC)	SQ YD	28.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
42300400	PCC DRIVEWAY PAVT 8	SQ YD	1,290.000				
42400200	PC CONC SIDEWALK 5	SQ FT	4,771.000				
44000100	PAVEMENT REM	SQ YD	2,158.000				
44000200	DRIVE PAVEMENT REM	SQ YD	125.000				
44000300	CURB REM	FOOT	50.000				
44000500	COMB CURB GUTTER REM	FOOT	774.000				
44000600	SIDEWALK REM	SQ FT	16,344.000				
44001980	CONC BARRIER REMOV	FOOT	507.000				
50100100	REM EXIST STRUCT	EACH	1.000				
50157300	PROTECTIVE SHIELD	SQ YD	1,394.000				
50200100	STRUCTURE EXCAVATION	CU YD	3,368.000				
50300225	CONC STRUCT	CU YD	1,060.100				
50300254	RUBBED FINISH	SQ FT	4,065.000				
50300255	CONC SUP-STR	CU YD	209.300				
50300285	FORM LINER TEX SURF	SQ FT	1,020.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK- -

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
50300300	PROTECTIVE COAT	SQ YD	395.000				
50500105	F & E STRUCT STEEL	L SUM	1.000				
50500505	STUD SHEAR CONNECTORS	EACH	6,806.000				
50800105	REINFORCEMENT BARS	POUND	292,640.000				
50800205	REINF BARS, EPOXY CTD	POUND	168,910.000				
51500100	NAME PLATES	EACH	1.000				
51602000	PERMANENT CASING	FOOT	1,554.000				
51603000	DRILLED SHAFT IN SOIL	CU YD	1,318.900				
51604000	DRILLED SHAFT IN ROCK	CU YD	38.200				
52100010	ELAST BEARING ASSY T1	EACH	18.000				
52100020	ELAST BEARING ASSY T2	EACH	9.000				
52100520	ANCHOR BOLTS 1	EACH	18.000				
52100530	ANCHOR BOLTS 1 1/4	EACH	36.000				
550A0050	STORM SEW CL A 1 12	FOOT	100.000				
550A0330	STORM SEW CL A 2 10	FOOT	6.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK- -

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
550A0340	STORM SEW CL A 2 12	FOOT	18.000				
55100400	STORM SEWER REM 10	FOOT	22.000				
58700300	CONCRETE SEALER	SQ FT	8,459.000				
59100100	GEOCOMPOSITE WALL DR	SQ YD	535.000				
60200105	CB TA 4 DIA T1F OL	EACH	5.000				
60201310	CB TA 4 DIA T20F&G	EACH	2.000				
60208210	CB TC T20F&G	EACH	1.000				
60250200	CB ADJUST	EACH	5.000				
60255500	MAN ADJUST	EACH	7.000				
60500040	REMOV MANHOLES	EACH	1.000				
60500050	REMOV CATCH BAS	EACH	4.000				
60500060	REMOV INLETS	EACH	2.000				
60500405	FILL VALVE VLTS	EACH	1.000				
60605000	COMB CC&G TB6.24	FOOT	188.000				
60618300	CONC MEDIAN SURF 4	SQ FT	73.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
63200310	GUARDRAIL REMOV	FOOT	305.000				
66400105	CH LK FENCE 4	FOOT	5.000				
66400305	CH LK FENCE 6	FOOT	58.000				
66900200	NON SPL WASTE DISPOSL	CU YD	10,400.000				
66900450	SPL WASTE PLNS/REPORT	L SUM	1.000				
66900530	SOIL DISPOSAL ANALY	EACH	4.000				
67100100	MOBILIZATION	L SUM	1.000				
70103815	TR CONT SURVEILLANCE	CAL DA	259.000				
70106800	CHANGEABLE MESSAGE SN	CAL MO	35.000				
70301000	WORK ZONE PAVT MK REM	SQ FT	3,880.000				
70400100	TEMP CONC BARRIER	FOOT	1,463.000				
70400200	REL TEMP CONC BARRIER	FOOT	463.000				
70600260	IMP ATTN TEMP FRN TL3	EACH	2.000				
70600332	IMP ATTN REL FRN TL3	EACH	1.000				
72000100	SIGN PANEL T1	SQ FT	28.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
72000200	SIGN PANEL T2	SQ FT	35.000				
72000300	SIGN PANEL T3	SQ FT	1,031.000				
72400100	REMOV SIN PAN ASSY TA	EACH	7.000				
72400200	REMOV SIN PAN ASSY TB	EACH	1.000				
72400310	REMOV SIGN PANEL T1	SQ FT	6.000				
72400320	REMOV SIGN PANEL T2	SQ FT	12.000				
72400330	REMOV SIGN PANEL T3	SQ FT	181.000				
72400730	RELOC SIGN PANEL T3	SQ FT	181.000				
72800100	TELES STL SIN SUPPORT	FOOT	35.000				
73000100	WOOD SIN SUPPORT	FOOT	45.000				
73304000	OVHD SIN STR BR MT	FOOT	35.000				
73602000	REM OVHD SN STR-BR MT	EACH	4.000				
73700100	REM GR MT SIN SUPPORT	EACH	2.000				
78005110	EPOXY PVT MK LINE 4	FOOT	2,914.000				
78005120	EPOXY PVT MK LINE 5	FOOT	1,925.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
78005140	EPOXY PVT MK LINE 8	FOOT	4,182.000				
78005150	EPOXY PVT MK LINE 12	FOOT	421.000				
78100100	RAISED REFL PAVT MKR	EACH	103.000				
78100300	REPLACEMENT REFLECTOR	EACH	387.000				
78200530	BAR WALL MKR TYPE C	EACH	127.000				
78300100	PAVT MARKING REMOVAL	SQ FT	4,687.000				
78300200	RAISED REF PVT MK REM	EACH	98.000				
81028220	UNDRGRD C GALVS 3	FOOT	240.000				
81028350	UNDRGRD C PVC 2	FOOT	255.000				
81028370	UNDRGRD C PVC 3	FOOT	1,688.000				
81100320	CON AT ST 1 PVC GS	FOOT	495.000				
81100805	CON AT ST 3 PVC GALVS	FOOT	130.000				
81101005	CON AT ST 4 PVC GALVS	FOOT	2,280.000				
81200230	CON EMB STR 2 PVC	FOOT	960.000				
81300530	JUN BX SS AS 12X10X6	EACH	17.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
81300830	JUN BX SS AS 18X18X8	EACH	12.000				
81400200	HD HANDHOLE	EACH	3.000				
81603000	UD 2#8 #8G XLP USE 3/4	FOOT	190.000				
81603081	UD 3#2#4GXLP USE 1.5 P	FOOT	340.000				
81702110	EC C XLP USE 1C 10	FOOT	1,560.000				
81702120	EC C XLP USE 1C 8	FOOT	255.000				
81702130	EC C XLP USE 1C 6	FOOT	510.000				
81702140	EC C XLP USE 1C 4	FOOT	135.000				
81702150	EC C XLP USE 1C 2	FOOT	400.000				
81800300	A CBL 3-1C2 MESS WIRE	FOOT	650.000				
82102150	LUM SV HOR MT 150W	EACH	16.000				
82107200	UNDERPAS LUM 100W HPS	EACH	8.000				
83000023	LT P A 18MH 8 DA	EACH	12.000				
83000024	LT P A 18MH 8 DA-TW	EACH	2.000				
84200500	REM LT UNIT SALV	EACH	12.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60W29

State Job # - C-91-231-13

County Name - COOK--

Code - 31 - -

District - 1 - -

Section Number - 2013-011R

Project Number
 ACNHPP-0290/200/

Route
 FAI 290

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
84200804	REM POLE FDN	EACH	15.000				
87000885	ECA C XLPTC 2C 6 8	FOOT	1,478.000				
87301727	ELCBL C COMM 19 6C	FOOT	1,478.000				
87900200	DRILL EX HANDHOLE	EACH	11.000				
89502380	REMOV EX HANDHOLE	EACH	3.000				

CONTRACT NUMBER

60W29

THIS IS THE TOTAL BID

\$ _____

NOTES:

1. Each PAY ITEM should have a UNIT PRICE and a TOTAL PRICE.
2. The UNIT PRICE shall govern if no TOTAL PRICE is shown or if there is a discrepancy between the product of the UNIT PRICE multiplied by the QUANTITY.
3. If a UNIT PRICE is omitted, the TOTAL PRICE will be divided by the QUANTITY in order to establish a UNIT PRICE.
4. A bid may be declared UNACCEPTABLE if neither a unit price nor a total price is shown.

RETURN WITH BID

STATE REQUIRED ETHICAL STANDARDS GOVERNING CONTRACT PROCUREMENT: ASSURANCES, CERTIFICATIONS AND DISCLOSURES

I. GENERAL

A. Article 50 of the Code establishes the duty of all State CPOs, SPOs, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

B. In order to comply with the provisions of Article 50 and to carry out the duty established therein, all bidders are to adhere to ethical standards established for the procurement process, and to make such assurances, disclosures and certifications required by law. Except as otherwise required in subsection III, paragraphs J-M, by execution of the Proposal Signature Sheet, the bidder indicates that each of the mandated assurances have been read and understood, that each certification is made and understood, and that each disclosure requirement has been understood and completed.

C. In addition to all other remedies provided by law, failure to comply with any assurance, failure to make any disclosure or the making of a false certification shall be grounds for the CPO to void the contract, and may result in the suspension or debarment of the bidder or subcontractor. If a false certification is made by a subcontractor the contractor's submitted bid and the executed contract may not be declared void unless the contractor refuses to terminate the subcontract upon the State's request after a finding that the subcontractor's certification was false.

I acknowledge, understand and accept these terms and conditions.

II. ASSURANCES

The assurances hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder.

A. Conflicts of Interest

Section 50-13. Conflicts of Interest.

(a) Prohibition. It is unlawful for any person holding an elective office in this State, holding a seat in the General Assembly, or appointed to or employed in any of the offices or agencies of state government and who receives compensation for such employment in excess of 60% of the salary of the Governor of the State of Illinois, or who is an officer or employee of the Capital Development Board or the Illinois State Toll Highway Authority, or who is the spouse or minor child of any such person to have or acquire any contract, or any direct pecuniary interest in any contract therein, whether for stationery, printing, paper, or any services, materials, or supplies, that will be wholly or partially satisfied by the payment of funds appropriated by the General Assembly of the State of Illinois or in any contract of the Capital Development Board or the Illinois State Toll Highway Authority.

(b) Interests. It is unlawful for any firm, partnership, association or corporation, in which any person listed in subsection (a) is entitled to receive (i) more than 7 1/2% of the total distributable income or (ii) an amount in excess of the salary of the Governor, to have or acquire any such contract or direct pecuniary interest therein.

(c) Combined interests. It is unlawful for any firm, partnership, association, or corporation, in which any person listed in subsection (a) together with his or her spouse or minor children is entitled to receive (i) more than 15%, in the aggregate, of the total distributable income or (ii) an amount in excess of 2 times the salary of the Governor, to have or acquire any such contract or direct pecuniary interest therein.

(d) Securities. Nothing in this Section invalidates the provisions of any bond or other security previously offered or to be offered for sale or sold by or for the State of Illinois.

(e) Prior interests. This Section does not affect the validity of any contract made between the State and an officer or employee of the State or member of the General Assembly, his or her spouse, minor child or any combination of those persons if that contract was in existence before his or her election or employment as an officer, member, or employee. The contract is voidable, however, if it cannot be completed within 365 days after the officer, member, or employee takes office or is employed.

The current salary of the Governor is \$177,412.00. Sixty percent of the salary is \$106,447.20.

RETURN WITH BID

The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-13, or that an effective exemption has been issued by the Board of Ethics to any individual subject to the Section 50-13 prohibitions pursuant to the provisions of Section 50-20 of the Code. Information concerning the exemption process is available from the Department upon request.

B. Negotiations

Section 50-15. Negotiations.

It is unlawful for any person employed in or on a continual contractual relationship with any of the offices or agencies of State government to participate in contract negotiations on behalf of that office or agency with any firm, partnership, association, or corporation with whom that person has a contract for future employment or is negotiating concerning possible future employment.

The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-15, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

C. Inducements

Section 50-25. Inducement.

Any person who offers or pays any money or other valuable thing to any person to induce him or her not to bid for a State contract or as recompense for not having bid on a State contract is guilty of a Class 4 felony. Any person who accepts any money or other valuable thing for not bidding for a State contract or who withholds a bid in consideration of the promise for the payment of money or other valuable thing is guilty of a Class 4 felony.

The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-25, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

D. Revolving Door Prohibition

Section 50-30. Revolving door prohibition.

CPOs, SPOs, procurement compliance monitors, their designees whose principal duties are directly related to State procurement, and executive officers confirmed by the Senate are expressly prohibited for a period of 2 years after terminating an affected position from engaging in any procurement activity relating to the State agency most recently employing them in an affected position for a period of at least 6 months. The prohibition includes, but is not limited to: lobbying the procurement process; specifying; bidding; proposing bid, proposal, or contract documents; on their own behalf or on behalf of any firm, partnership, association, or corporation. This Section applies only to persons who terminate an affected position on or after January 15, 1999.

The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-30, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

E. Reporting Anticompetitive Practices

Section 50-40. Reporting anticompetitive practices.

When, for any reason, any vendor, bidder, contractor, CPO, SPO, designee, elected official, or State employee suspects collusion or other anticompetitive practice among any bidders, offerors, contractors, proposers, or employees of the State, a notice of the relevant facts shall be transmitted to the Attorney General and the CPO.

The bidder assures the Department that it has not failed to report any relevant facts concerning the practices addressed in Section 50-40 which may involve the contract for which the bid is submitted.

F. Confidentiality

Section 50-45. Confidentiality.

Any CPO, SPO, designee, or executive officer who willfully uses or allows the use of specifications, competitive bid documents, proprietary competitive information, proposals, contracts, or selection information to compromise the fairness or integrity of the procurement, bidding, or contract process shall be subject to immediate dismissal, regardless of the Personnel code, any contract, or any collective bargaining agreement, and may in addition be subject to criminal prosecution.

The bidder assures the Department that it has no knowledge of any fact relevant to the practices addressed in Section 50-45 which may involve the contract for which the bid is submitted.

RETURN WITH BID

G. Insider Information

Section 50-50. Insider information.

It is unlawful for any current or former elected or appointed State official or State employee to knowingly use confidential information available only by virtue of that office or employment for actual or anticipated gain for themselves or another person.

The bidder assures the Department that it has no knowledge of any facts relevant to the practices addressed in Section 50-50 which may involve the contract for which the bid is submitted.

I acknowledge, understand and accept these terms and conditions for the above assurances.

III. CERTIFICATIONS

The certifications hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. Section 50-2 of the Code provides that every person that has entered into a multi-year contract and every subcontractor with a multi-year subcontract shall certify, by July 1 of each fiscal year covered by the contract after the initial fiscal year, to the responsible CPO whether it continues to satisfy the requirements of Article 50 pertaining to the eligibility for a contract award. If a contractor or subcontractor is not able to truthfully certify that it continues to meet all requirements, it shall provide with its certification a detailed explanation of the circumstances leading to the change in certification status. A contractor or subcontractor that makes a false statement material to any given certification required under Article 50 is, in addition to any other penalties or consequences prescribed by law, subject to liability under the Whistleblower Reward and Protection Act for submission of a false claim.

A. Bribery

Section 50-5. Bribery.

(a) Prohibition. No person or business shall be awarded a contract or subcontract under this Code who:

(1) has been convicted under the laws of Illinois or any other state of bribery or attempting to bribe an officer or employee of the State of Illinois or any other state in that officer's or employee's official capacity; or

(2) has made an admission of guilt of that conduct that is a matter of record but has not been prosecuted for that conduct.

(b) Businesses. No business shall be barred from contracting with any unit of State or local government, or subcontracting under such a contract, as a result of a conviction under this Section of any employee or agent of the business if the employee or agent is no longer employed by the business and:

(1) the business has been finally adjudicated not guilty; or

(2) the business demonstrates to the governmental entity with which it seeks to contract, or which is signatory to the contract which the subcontract relates, and that entity finds that the commission of the offense was not authorized, requested, commanded, or performed by a director, officer, or high managerial agent on behalf of the business as provided in paragraph (2) of subsection (a) of Section 5-4 of the Criminal Code of 2012.

(c) Conduct on behalf of business. For purposes of this Section, when an official, agent, or employee of a business committed the bribery or attempted bribery on behalf of the business and in accordance with the direction or authorization of a responsible official of the business, the business shall be chargeable with the conduct.

(d) Certification. Every bid submitted to and contract executed by the State, and every subcontract subject to Section 20-120 of the Code shall contain a certification by the contractor or the subcontractor, respectively, that the contractor or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the CPO may declare the related contract void if any certifications required by this Section are false. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

The contractor or subcontractor certifies that it is not barred from being awarded a contract under Section 50.5.

B. Felons

Section 50-10. Felons.

(a) Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any State agency, or enter into a subcontract, from the date of conviction until 5 years after the date of completion of the sentence for that felony, unless no person held responsible by a prosecutorial office for the facts upon which the conviction was based continues to have any involvement with the business.

(b) Certification. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Code shall contain a certification by the bidder or contractor or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the CPO may declare the related contract void if any of the certifications required by this Section are false.

RETURN WITH BID

C. Debt Delinquency

Section 50-11 and 50-12. Debt Delinquency.

The contractor or bidder or subcontractor, respectively, certifies that it, or any affiliate, is not barred from being awarded a contract or subcontract under the Code. Section 50-11 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it knows or should know that it, or any affiliate, is delinquent in the payment of any debt to the State as defined by the Debt Collection Board. Section 50-12 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it, or any affiliate, has failed to collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act. The bidder or contractor or subcontractor, respectively, further acknowledges that the CPO may declare the related contract void if this certification is false or if the bidder, contractor, or subcontractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

D. Prohibited Bidders, Contractors and Subcontractors

Section 50-10.5 and 50-60(c). Prohibited bidders, contractors and subcontractors.

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-10.5 that no officer, director, partner or other managerial agent of the contracting business has been convicted of a felony under the Sarbanes-Oxley Act of 2002 or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953 or if in violation of Subsection (c) for a period of five years from the date of conviction. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Code shall contain a certification by the bidder, contractor, or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the CPO shall declare the related contract void if any of the certifications completed pursuant to this Section are false.

E. Section 42 of the Environmental Protection Act

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-14 that the bidder, contractor, or subcontractor, is not barred from being awarded a contract or entering into a subcontract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency, or entering into any subcontract, that is subject to the Code by a person or business found by a court or the Pollution Control Board to have committed a willful or knowing violation of Section 42 of the Environmental Protection Act for a period of five years from the date of the order. The bidder or contractor or subcontractor, respectively, acknowledges that the CPO may declare the contract void if this certification is false.

F. Educational Loan

Section 3 of the Educational Loan Default Act provides no State agency shall contract with an individual for goods or services if that individual is in default, as defined in Section 2 of this Act, on an educational loan. Any contract used by any State agency shall include a statement certifying that the individual is not in default on an educational loan as provided in this Section.

The bidder, if an individual as opposed to a corporation, partnership or other form of business organization, certifies that the bidder is not in default on an educational loan as provided in Section 3 of the Act.

G. Bid-Rigging/Bid Rotating

Section 33E-11 of the Criminal Code of 2012 provides:

(a) Every bid submitted to and public contract executed pursuant to such bid by the State or a unit of local government shall contain a certification by the prime contractor that the prime contractor is not barred from contracting with any unit of State or local government as a result of a violation of either Section 33E-3 or 33E-4 of this Article.

(b) A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

A violation of Section 33E-3 would be represented by a conviction of the crime of bid-rigging which, in addition to Class 3 felony sentencing, provides that any person convicted of this offense or any similar offense of any state or the United States which contains the same elements as this offense shall be barred for 5 years from the date of conviction from contracting with any unit of State or local government. No corporation shall be barred from contracting with any unit of State or local government as a result of a conviction under this Section of any employee or agent of such corporation if the employee so convicted is no longer employed by the corporation and: (1) it has been finally adjudicated not guilty or (2) if it demonstrates to the governmental entity with which it seeks to contract and that entity finds that the commission of the offense was neither authorized, requested, commanded, nor performed by a director, officer or a high managerial agent in behalf of the corporation.

RETURN WITH BID

A violation of Section 33E-4 would be represented by a conviction of the crime of bid-rotating which, in addition to Class 2 felony sentencing, provides that any person convicted of this offense or any similar offense of any state or the United States which contains the same elements as this offense shall be permanently barred from contracting with any unit of State or local government. No corporation shall be barred from contracting with any unit of State or local government as a result of a conviction under this Section of any employee or agent of such corporation if the employee so convicted is no longer employed by the corporation and: (1) it has been finally adjudicated not guilty or (2) if it demonstrates to the governmental entity with which it seeks to contract and that entity finds that the commission of the offense was neither authorized, requested, commanded, nor performed by a director, officer or a high managerial agent in behalf of the corporation.

The bidder certifies that it is not barred from contracting with the Department by reason of a violation of either Section 33E-3 or Section 33E-4.

H. International Anti-Boycott

Section 5 of the International Anti-Boycott Certification Act provides every contract entered into by the State of Illinois for the manufacture, furnishing, or purchasing of supplies, material, or equipment or for the furnishing of work, labor, or services, in an amount exceeding the threshold for small purchases according to the purchasing laws of this State or \$10,000.00, whichever is less, shall contain certification, as a material condition of the contract, by which the contractor agrees that neither the contractor nor any substantially-owned affiliated company is participating or shall participate in an international boycott in violation of the provisions of the U.S. Export Administration Act of 1979 or the regulations of the U.S. Department of Commerce promulgated under that Act.

The bidder makes the certification set forth in Section 5 of the Act.

I. Drug Free Workplace

The Illinois "Drug Free Workplace Act" applies to this contract and it is necessary to comply with the provisions of the "Act" if the contractor is a corporation, partnership, or other entity (including a sole proprietorship) which has 25 or more employees.

The bidder certifies that if awarded a contract in excess of \$5,000 it will provide a drug free workplace in compliance with the provisions of the Act.

J. Disclosure of Business Operations in Iran

Section 50-36 of the Code, 30ILCS 500/50-36 provides that each bid, offer, or proposal submitted for a State contract shall include a disclosure of whether or not the Company acting as the bidder, offeror, or proposing entity, or any of its corporate parents or subsidiaries, within the 24 months before submission of the bid, offer, or proposal had business operations that involved contracts with or provision of supplies or services to the Government of Iran, companies in which the Government of Iran has any direct or indirect equity share, consortiums or projects commissioned by the Government of Iran, or companies involved in consortiums or projects commissioned by the Government of Iran and either of the following conditions apply:

- (1) More than 10% of the Company's revenues produced in or assets located in Iran involve oil-related activities or mineral-extraction activities; less than 75% of the Company's revenues produced in or assets located in Iran involve contracts with or provision of oil-related or mineral-extraction products or services to the Government of Iran or a project or consortium created exclusively by that government; and the Company has failed to take substantial action.
- (2) The Company has, on or after August 5, 1996, made an investment of \$20 million or more, or any combination of investments of at least \$10 million each that in the aggregate equals or exceeds \$20 million in any 12-month period, which directly or significantly contributes to the enhancement of Iran's ability to develop petroleum resources of Iran.

The terms "Business operations", "Company", "Mineral-extraction activities", "Oil-related activities", "Petroleum resources", and "Substantial action" are all defined in the Code.

Failure to make the disclosure required by the Code shall cause the bid, offer or proposal to be considered not responsive. The disclosure will be considered when evaluating the bid or awarding the contract. The name of each Company disclosed as doing business or having done business in Iran will be provided to the State Comptroller.

Check the appropriate statement:

Company has no business operations in Iran to disclose.

Company has business operations in Iran as disclosed the attached document.

RETURN WITH BID

K. Apprenticeship and Training Certification (Does not apply to federal aid projects)

In accordance with the provisions of Section 30-22 (6) of the Code, the bidder certifies that it is a participant, either as an individual or as part of a group program, in the approved apprenticeship and training programs applicable to each type of work or craft that the bidder will perform with its own forces. The bidder further certifies for work that will be performed by subcontract that each of its subcontractors submitted for approval either (a) is, at the time of such bid, participating in an approved, applicable apprenticeship and training program; or (b) will, prior to commencement of performance of work pursuant to this contract, begin participation in an approved apprenticeship and training program applicable to the work of the subcontract. The Department, at any time before or after award, may require the production of a copy of each applicable Certificate of Registration issued by the United States Department of Labor evidencing such participation by the contractor and any or all of its subcontractors. Applicable apprenticeship and training programs are those that have been approved and registered with the United States Department of Labor. The bidder shall list in the space below, the official name of the program sponsor holding the Certificate of Registration for all of the types of work or crafts in which the bidder is a participant and that will be performed with the bidder's forces. Types of work or craft work that will be subcontracted shall be included and listed as subcontract work. The list shall also indicate any type of work or craft job category that does not have an applicable apprenticeship or training program. **The bidder is responsible for making a complete report and shall make certain that each type of work or craft job category that will be utilized on the project as reported on the Construction Employee Workforce Projection (Form BC-1256) and returned with the bid is accounted for and listed.**

NA-FEDERAL

The requirements of this certification and disclosure are a material part of the contract, and the contractor shall require this certification provision to be included in all approved subcontracts. In order to fulfill this requirement, it shall not be necessary that an applicable program sponsor be currently taking or that it will take applications for apprenticeship, training or employment during the performance of the work of this contract.

RETURN WITH BID

L. Political Contributions and Registration with the State Board of Elections

Sections 20-160 and 50-37 of the Code regulate political contributions from business entities and any affiliated entities or affiliated persons bidding on or contracting with the state. Generally under Section 50-37, any business entity, and any affiliated entity or affiliated person of the business entity, whose current year contracts with all state agencies exceed an awarded value of \$50,000, are prohibited from making any contributions to any political committees established to promote the candidacy of the officeholder responsible for the awarding of the contracts or any other declared candidate for that office for the duration of the term of office of the incumbent officeholder or a period 2 years after the termination of the contract, whichever is longer. Any business entity and affiliated entities or affiliated persons whose state contracts in the current year do not exceed an awarded value of \$50,000, but whose aggregate pending bids and proposals on state contracts exceed \$50,000, either alone or in combination with contracts not exceeding \$50,000, are prohibited from making any political contributions to any political committee established to promote the candidacy of the officeholder responsible for awarding the pending contract during the period beginning on the date the invitation for bids or request for proposals is issued and ending on the day after the date of award or selection if the entity was not awarded or selected. Section 20-160 requires certification of registration of affected business entities in accordance with procedures found in Section 9-35 of The Election Code.

By submission of a bid, the contractor business entity acknowledges and agrees that it has read and understands Sections 20-160 and 50-37 of the Code, and that it makes the following certification:

The undersigned bidder certifies that it has registered as a business with the State Board of Elections and acknowledges a continuing duty to update the registration in accordance with the above referenced statutes. If the business entity is required to register, the CPO shall verify that it is in compliance on the date the bid or proposal is due. The CPO shall not accept a bid or proposal if the business entity is not in compliance with the registration requirements.

These requirements and compliance with the above referenced statutory sections are a material part of the contract, and any breach thereof shall be cause to void the contract under Section 50-60 of the Code. This provision does not apply to Federal-aid contracts.

M. Lobbyist Disclosure

Section 50-38 of the Code requires that any bidder or offeror on a State contract that hires a person required to register under the Lobbyist Registration Act to assist in obtaining a contract shall:

- (i) Disclose all costs, fees, compensation, reimbursements, and other remunerations paid or to be paid to the lobbyist related to the contract,
- (ii) Not bill or otherwise cause the State of Illinois to pay for any of the lobbyist's costs, fees, compensation, reimbursements, or other remuneration, and
- (iii) Sign a verification certifying that none of the lobbyist's costs, fees, compensation, reimbursements, or other remuneration were billed to the State.

This information, along with all supporting documents, shall be filed with the agency awarding the contract and with the Secretary of State. The CPO shall post this information, together with the contract award notice, in the online Procurement Bulletin.

Pursuant to Subsection (c) of this Section, no person or entity shall retain a person or entity to attempt to influence the outcome of a procurement decision made under the Code for compensation contingent in whole or in part upon the decision or procurement. Any person who violates this subsection is guilty of a business offense and shall be fined not more than \$10,000.

Bidder acknowledges that it is required to disclose the hiring of any person required to register pursuant to the Illinois Lobbyist Registration Act (25 ILCS 170) in connection with this contract.

Bidder has not hired any person required to register pursuant to the Illinois Lobbyist Registration Act in connection with this contract.

Or

Bidder has hired the following persons required to register pursuant to the Illinois Lobbyist Registration Act in connection with the contract:

Name and address of person: _____
All costs, fees, compensation, reimbursements and other remuneration paid to said person: _____

I acknowledge, understand and accept these terms and conditions for the above certifications.

RETURN WITH BID

IV. DISCLOSURES

- A. The disclosures hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. The bidder further certifies that the Department has received the disclosure forms for each bid.

The CPO may void the bid, or contract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Code. Furthermore, the CPO may void the contract and the surety providing the performance bond shall be responsible for completion of the contract.

B. Financial Interests and Conflicts of Interest

1. Section 50-35 of the Code provides that all bids of more than \$25,000 shall be accompanied by disclosure of the financial interests of the bidder. This disclosed information for the successful bidder, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the contract. Furthermore, pursuant to Section 5-5, the Procurement Policy Board may review a proposal, bid, or contract and issue a recommendation to void a contract or reject a proposal or bid based on any violation of the Code or the existence of a conflict of interest as provided in subsections (b) and (d) of Section 50-35.

The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the bidding entity or its parent entity, whichever is less, unless the contractor or bidder is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form.
The current annual salary of the Governor is \$177,412.00.

In addition, all disclosures shall indicate any other current or pending contracts, proposals, leases, or other ongoing procurement relationships the bidding entity has with any other unit of state government and shall clearly identify the unit and the contract, proposal, lease, or other relationship.

2. Disclosure Forms. Disclosure Form A is attached for use concerning the individuals meeting the above ownership or distributive share requirements. A separate Disclosure Form A must be submitted with the bid for each individual meeting the above requirements. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies and a total ownership certification. **The forms must be included with each bid.**

C. Disclosure Form Instructions

Form A Instructions for Financial Information & Potential Conflicts of Interest

If the bidder is a publicly traded entity subject to Federal 10K reporting, the 10K Report may be submitted to meet the requirements of Form A. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. If a bidder is not subject to Federal 10K reporting, the bidder must determine if any individuals are required by law to complete a financial disclosure form. To do this, the bidder should answer each of the following questions. A "YES" answer indicates Form A must be completed. If the answer to each of the following questions is "NO", then the NOT APPLICABLE STATEMENT on Form A must be signed and dated by a person that is authorized to execute contracts for the bidding company. Note: These questions are for assistance only and are not required to be completed.

1. Does anyone in your organization have a direct or beneficial ownership share of greater than 5% of the bidding entity or parent entity? YES ___ NO ___
2. Does anyone in your organization have a direct or beneficial ownership share of less than 5%, but which has a value greater than 60% of the annual salary of the Governor? YES ___ NO ___
3. Does anyone in your organization receive more than 60% of the annual salary of the Governor of the bidding entity's or parent entity's distributive income? YES ___ NO ___
4. Does anyone in your organization receive greater than 5% of the bidding entity's or parent entity's total distributive income, but which is less than 60% of the annual salary of the Governor? YES ___ NO ___

(Note: Only one set of forms needs to be completed per person per bid even if a specific individual would require a yes answer to more than one question.)

A "YES" answer to any of these questions requires the completion of Form A. The bidder must determine each individual in the bidding entity or the bidding entity's parent company that would cause the questions to be answered "Yes". Each form must be signed and dated by a person that is authorized to execute contracts for your organization. **Photocopied or stamped signatures are not acceptable.** The person signing can be, but does not have to be, the person for which the form is being completed. The bidder is responsible for the accuracy of any information provided.

If the answer to each of the above questions is "NO", then the NOT APPLICABLE STATEMENT of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

RETURN WITH BID

Form B: Instructions for Identifying Other Contracts & Procurement Related Information

Disclosure Form B must be completed for each bid submitted by the bidding entity. *Note: Checking the NOT APPLICABLE STATEMENT on Form A does not allow the bidder to ignore Form B. Form B must be completed, checked, and dated or the bidder may be considered nonresponsive and the bid will not be accepted.*

The Bidder shall identify, by checking Yes or No on Form B, whether it has any pending contracts (including leases), bids, proposals, or other ongoing procurement relationship with any other (non-IDOT) State of Illinois agency. If "No" is checked, the bidder only needs to complete the check box on the bottom of Form B. If "Yes" is checked, the bidder must do one of the following:

Option I: If the bidder did not submit an Affidavit of Availability to obtain authorization to bid, the bidder must list all non-IDOT State of Illinois agency pending contracts, leases, bids, proposals, and other ongoing procurement relationships. These items may be listed on Form B or on an attached sheet(s). Do not include IDOT contracts. Contracts with cities, counties, villages, etc. are not considered State of Illinois agency contracts and are not to be included. Contracts with other State of Illinois agencies such as the Department of Natural Resources or the Capital Development Board must be included. Bidders who submit Affidavits of Availability are suggested to use Option II.

Option II: If the bidder is required and has submitted an Affidavit of Availability in order to obtain authorization to bid, the bidder may write or type "See Affidavit of Availability" which indicates that the Affidavit of Availability is incorporated by reference and includes all non-IDOT State of Illinois agency pending contracts, leases, bids, proposals, and other ongoing procurement relationships. For any contracts that are not covered by the Affidavit of Availability, the bidder must identify them on Form B or on an attached sheet(s). These might be such things as leases.

RETURN WITH BID

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form A Financial Information & Potential Conflicts of Interest Disclosure

Contractor Name
Legal Address
City, State, Zip
Telephone Number Email Address Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Code (30 ILCS 500). Vendors desiring to enter into a contract with the State of Illinois must disclose the financial information and potential conflict of interest information as specified in this Disclosure Form. This information shall become part of the publicly available contract file. This Form A must be completed for bids in excess of \$25,000, and for all open-ended contracts. A publicly traded company may submit a 10K disclosure (or equivalent if applicable) in satisfaction of the requirements set forth in Form A. See Disclosure Form Instructions.

The current annual salary of the Governor is \$177,412.00.

DISCLOSURE OF FINANCIAL INFORMATION

- 1. Disclosure of Financial Information. The individual named below has an interest in the BIDDER (or its parent) in terms of ownership or distributive income share in excess of 5%, or an interest which has a value of more than 60% of the annual salary of the Governor. (Make copies of this form as necessary and attach a separate Disclosure Form A for each individual meeting these requirements)

FOR INDIVIDUAL (type or print information)
NAME:
ADDRESS
Type of ownership/distributable income share:
stock sole proprietorship Partnership other: (explain on separate sheet):
% or \$ value of ownership/distributable income share:

- 2. Disclosure of Potential Conflicts of Interest. Check "Yes" or "No" to indicate which, if any, of the following potential conflict of interest relationships apply. If the answer to any question is "Yes", please attach additional pages and describe.

(a) State employment, currently or in the previous 3 years, including contractual employment of services. Yes ___ No ___

If your answer is yes, please answer each of the following questions.

- 1. Are you currently an officer or employee of either the Capitol Development Board or the Illinois State Toll Highway Authority? Yes ___ No ___
2. Are you currently appointed to or employed by any agency of the State of Illinois? If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor provide the name the State agency for which you are employed and your annual salary.

RETURN WITH BID

3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 100% of the annual salary of the Governor? Yes ___ No ___
4. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or minor children entitled to receive (i) more than 15% in aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor? Yes ___ No ___

(b) State employment of spouse, father, mother, son, or daughter, including contractual employment for services in the previous 2 years.

Yes ___ No ___

If your answer is yes, please answer each of the following questions.

1. Is your spouse or any minor children currently an officer or employee of the Capitol Development Board or the Illinois State Toll Highway Authority? Yes ___ No ___
2. Is your spouse or any minor children currently appointed to or employed by any agency of the State of Illinois? If your spouse or minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, provide the name of the spouse and/or minor children, the name of the State agency for which he/she is employed and his/her annual salary. _____

-
3. If your spouse or any minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess 100% of the annual salary of the Governor? Yes ___ No ___
4. If your spouse or any minor children are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or any minor children entitled to receive (i) more than 15% in the aggregate of the total distributable income from your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor? Yes ___ No ___

(c) Elective status; the holding of elective office of the State of Illinois, the government of the United States, any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois currently or in the previous 3 years. Yes ___ No ___

(d) Relationship to anyone holding elective office currently or in the previous 2 years; spouse, father, mother, son, or daughter. Yes ___ No ___

(e) Appointive office; the holding of any appointive government office of the State of Illinois, the United State of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of the expenses incurred in the discharge of that office currently or in the previous 3 years. Yes ___ No ___

(f) Relationship to anyone holding appointive office currently or in the previous 2 years; spouse, father, mother, son, or daughter. Yes ___ No ___

(g) Employment, currently or in the previous 3 years, as or by any registered lobbyist of the State government. Yes ___ No ___

RETURN WITH BID

(h) Relationship to anyone who is or was a registered lobbyist in the previous 2 years; spouse, father, mother, son, or daughter. Yes ___ No ___

(i) Compensated employment, currently or in the previous 3 years, by any registered election or reelection committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

(j) Relationship to anyone; spouse, father, mother, son, or daughter; who was a compensated employee in the last 2 years by any registered election or re-election committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

3. Communication Disclosure.

Disclose the name and address of each lobbyist and other agent of the bidder or offeror who is not identified in Section 2 of this form, who is has communicated, is communicating, or may communicate with any State officer or employee concerning the bid or offer. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the process and throughout the term of the contract. If no person is identified, enter "None" on the line below:

Name and address of person(s): _____

RETURN WITH BID

4. Debarment Disclosure. For each of the persons identified under Sections 2 and 3 of this form, disclose whether any of the following has occurred within the previous 10 years: debarment from contracting with any governmental entity; professional licensure discipline; bankruptcies; adverse civil judgments and administrative findings; and criminal felony convictions. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the procurement process and term of the contract. If no person is identified, enter "None" on the line below:

Name of person(s): _____

Nature of disclosure: _____

APPLICABLE STATEMENT

This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page. Under penalty of perjury, I certify the contents of this disclosure to be true and accurate to the best of my knowledge.

Completed by: _____ Date _____
Signature of Individual or Authorized Representative

NOT APPLICABLE STATEMENT

Under penalty of perjury, I have determined that no individuals associated with this organization meet the criteria that would require the completion of this Form A.

This Disclosure Form A is submitted on behalf of the CONTRACTOR listed on the previous page.

_____ Date _____
Signature of Authorized Representative

The bidder has a continuing obligation to supplement these disclosures under Sec. 50-35 of the Code.

RETURN WITH BID

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form B Other Contracts & Financial Related Information Disclosure

Contractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Code (30 ILCS 500). This information shall become part of the publicly available contract file. This Form B must be completed for bids in excess of \$25,000, and for all open-ended contracts.

DISCLOSURE OF OTHER CONTRACTS AND PROCUREMENT RELATED INFORMATION

1. Identifying Other Contracts & Procurement Related Information. The BIDDER shall identify whether it has any pending contracts (including leases), bids, proposals, or other ongoing procurement relationship with any other State of Illinois agency: Yes ___ No ___

If "No" is checked, the bidder only needs to complete the signature box on the bottom of this page.

2. If "Yes" is checked. Identify each such relationship by showing State of Illinois agency name and other descriptive information such as bid or project number (attach additional pages as necessary). SEE DISCLOSURE FORM INSTRUCTIONS:

THE FOLLOWING STATEMENT MUST BE CHECKED

Signature of Authorized Representative, Date

OWNERSHIP CERTIFICATION

Please certify that the following statement is true if the individuals for all submitted Form A disclosures do not total 100% of ownership.

Any remaining ownership interest is held by individuals receiving less than \$106,447.20 of the bidding entity's or parent entity's distributive income or holding less than a 5% ownership interest.

Yes No N/A (Form A disclosure(s) established 100% ownership)

RETURN WITH BID

SPECIAL NOTICE TO CONTRACTORS

The following requirements of the Illinois Department of Human Rights' Rules and Regulations are applicable to bidders on all construction contracts advertised by the Illinois Department of Transportation:

CONSTRUCTION EMPLOYEE UTILIZATION PROJECTION

- (a) All bidders on construction contracts shall complete and submit, along with and as part of their bids, a Bidder's Employee Utilization Form (Form BC-1256) setting forth a projection and breakdown of the total workforce intended to be hired and/or allocated to such contract work by the bidder including a projection of minority and female employee utilization in all job classifications on the contract project.
- (b) The Department of Transportation shall review the Employee Utilization Form, and workforce projections contained therein, of the contract awardee to determine if such projections reflect an underutilization of minority persons and/or women in any job classification in accordance with the Equal Employment Opportunity Clause and Section 7.2 of the Illinois Department of Human Rights' Rules and Regulations for Public Contracts adopted as amended on September 17, 1980. If it is determined that the contract awardee's projections reflect an underutilization of minority persons and/or women in any job classification, it shall be advised in writing of the manner in which it is underutilizing and such awardee shall be considered to be in breach of the contract unless, prior to commencement of work on the contract project, it submits revised satisfactory projections or an acceptable written affirmative action plan to correct such underutilization including a specific timetable geared to the completion stages of the contract.
- (c) The Department of Transportation shall provide to the Department of Human Rights a copy of the contract awardee's Employee Utilization Form, a copy of any required written affirmative action plan, and any written correspondence related thereto. The Department of Human Rights may review and revise any action taken by the Department of Transportation with respect to these requirements.



RETURN WITH BID

**Contract No. 60W29
COOK County
Section 2013-011R
Project ACNHPP-0290(200)
Route FAI 290
District 1 Construction Funds**

PART I. IDENTIFICATION

Dept. Human Rights # _____ Duration of Project: _____

Name of Bidder: _____

PART II. WORKFORCE PROJECTION

A. The undersigned bidder has analyzed minority group and female populations, unemployment rates and availability of workers for the location in which this contract work is to be performed, and for the locations from which the bidder recruits employees, and hereby submits the following workforce projection including a projection for minority and female employee utilization in all job categories in the workforce to be allocated to this contract:

TABLE A

TABLE B

TOTAL Workforce Projection for Contract													CURRENT EMPLOYEES TO BE ASSIGNED TO CONTRACT			
JOB CATEGORIES	TOTAL EMPLOYEES		MINORITY EMPLOYEES						TRAINEES				TOTAL EMPLOYEES		MINORITY EMPLOYEES	
			BLACK		HISPANIC		*OTHER MINOR.		APPRENTICES		ON THE JOB TRAINEES					
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS (MANAGERS)																
SUPERVISORS																
FOREMEN																
CLERICAL																
EQUIPMENT OPERATORS																
MECHANICS																
TRUCK DRIVERS																
IRONWORKERS																
CARPENTERS																
CEMENT MASONS																
ELECTRICIANS																
PIPEFITTERS, PLUMBERS																
PAINTERS																
LABORERS, SEMI-SKILLED																
LABORERS, UNSKILLED																
TOTAL																

TABLE C

TOTAL Training Projection for Contract								
EMPLOYEES IN TRAINING	TOTAL EMPLOYEES		BLACK		HISPANIC		*OTHER MINOR.	
	M	F	M	F	M	F	M	F
APPRENTICES								
ON THE JOB TRAINEES								

*Other minorities are defined as Asians (A) or Native Americans (N).
Please specify race of each employee shown in Other Minorities column.

FOR DEPARTMENT USE ONLY

BC 1256 (Rev. 12/11/07)

Note: See instructions on page 2

RETURN WITH BID

**Contract No. 60W29
COOK County
Section 2013-011R
Project ACNHPP-0290(200)
Route FAI 290
District 1 Construction Funds**

PART II. WORKFORCE PROJECTION - continued

- B. Included in "Total Employees" under Table A is the total number of **new hires** that would be employed in the event the undersigned bidder is awarded this contract.

The undersigned bidder projects that: (number) _____ new hires would be recruited from the area in which the contract project is located; and/or (number) _____ new hires would be recruited from the area in which the bidder's principal office or base of operation is located.

- C. Included in "Total Employees" under Table A is a projection of numbers of persons to be employed directly by the undersigned bidder as well as a projection of numbers of persons to be employed by subcontractors.

The undersigned bidder estimates that (number) _____ persons will be directly employed by the prime contractor and that (number) _____ persons will be employed by subcontractors.

PART III. AFFIRMATIVE ACTION PLAN

- A. The undersigned bidder understands and agrees that in the event the foregoing minority and female employee utilization projection included under **PART II** is determined to be an underutilization of minority persons or women in any job category, and in the event that the undersigned bidder is awarded this contract, he/she will, prior to commencement of work, develop and submit a written Affirmative Action Plan including a specific timetable (geared to the completion stages of the contract) whereby deficiencies in minority and/or female employee utilization are corrected. Such Affirmative Action Plan will be subject to approval by the contracting agency and the **Department of Human Rights**.
- B. The undersigned bidder understands and agrees that the minority and female employee utilization projection submitted herein, and the goals and timetable included under an Affirmative Action Plan if required, are deemed to be part of the contract specifications.

Company _____ Telephone Number _____

Address _____

NOTICE REGARDING SIGNATURE

The Bidder's signature on the Proposal Signature Sheet will constitute the signing of this form. The following signature block needs to be completed only if revisions are required.

Signature: _____ Title: _____ Date: _____

Instructions: All tables must include subcontractor personnel in addition to prime contractor personnel.

Table A - Include both the number of employees that would be hired to perform the contract work and the total number currently employed (Table B) that will be allocated to contract work, and include all apprentices and on-the-job trainees. The "Total Employees" column should include all employees including all minorities, apprentices and on-the-job trainees to be employed on the contract work.

Table B - Include all employees currently employed that will be allocated to the contract work including any apprentices and on-the-job trainees currently employed.

Table C - Indicate the racial breakdown of the total apprentices and on-the-job trainees shown in Table A.

RETURN WITH BID

ADDITIONAL FEDERAL REQUIREMENTS

In addition to the Required Contract Provisions for Federal-Aid Construction Contracts (FHWA 1273), all bidders make the following certifications.

- A. By the execution of this proposal, the signing bidder certifies that the bidding entity has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action, in restraint of free competitive bidding in connection with the submitted bid. This statement made by the undersigned bidder is true and correct under penalty of perjury under the laws of the United States.
- B. CERTIFICATION, EQUAL EMPLOYMENT OPPORTUNITY:
1. Have you participated in any previous contracts or subcontracts subject to the equal opportunity clause. YES _____ NO _____
 2. If answer to #1 is yes, have you filed with the Joint Reporting Committee, the Director of OFCC, any Federal agency, or the former President's Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements of those organizations?
YES _____ NO _____

RETURN WITH BID

**Contract No. 60W29
COOK County
Section 2013-011R
Project ACNHPP-0290(200)
Route FAI 290
District 1 Construction Funds**

PROPOSAL SIGNATURE SHEET

The undersigned bidder hereby makes and submits this bid on the subject Proposal, thereby assuring the Department that all requirements of the Invitation for Bids and rules of the Department have been met, that there is no misunderstanding of the requirements of paragraph 3 of this Proposal, and that the contract will be executed in accordance with the rules of the Department if an award is made on this bid.

(IF AN INDIVIDUAL)

Firm Name _____
Signature of Owner _____
Business Address _____

(IF A CO-PARTNERSHIP)

Firm Name _____
By _____
Business Address _____
Name and Address of All Members of the Firm: _____

(IF A CORPORATION)

Corporate Name _____
By _____
Signature of Authorized Representative _____
Typed or printed name and title of Authorized Representative _____
Attest _____
Signature _____
(IF A JOINT VENTURE, USE THIS SECTION FOR THE MANAGING PARTY AND THE SECOND PARTY SHOULD SIGN BELOW)
Business Address _____

(IF A JOINT VENTURE)

Corporate Name _____
By _____
Signature of Authorized Representative _____
Typed or printed name and title of Authorized Representative _____
Attest _____
Signature _____
Business Address _____

If more than two parties are in the joint venture, please attach an additional signature sheet.



This Annual Proposal Bid Bond shall become effective at 12:01 AM (CDST) on _____ and shall be valid until _____ 11:59 PM (CDST).

KNOW ALL PERSONS BY THESE PRESENTS, That We _____

as PRINCIPAL, and _____

as SURETY, and held jointly, severally and firmly bound unto the STATE OF ILLINOIS in the penal sum of 5 percent of the total bid price, or for the amount specified in the bid proposal under "Proposal Guaranty" in effect on the date of the Invitation for Bids, whichever is the lesser sum, well and truly to be paid unto said STATE OF ILLINOIS, for the payment of which we bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH that whereas, the PRINCIPAL may submit bid proposal(s) to the STATE OF ILLINOIS, acting through the Department of Transportation, for various improvements published in the Transportation Bulletin during the effective term indicated above.

NOW, THEREFORE, if the Department shall accept the bid proposal(s) of the PRINCIPAL; and if the PRINCIPAL shall, within the time and as specified in the bidding and contract documents; and if, after award by the Department, the PRINCIPAL shall enter into a contract in accordance with the terms of the bidding and contract documents including evidence of the required insurance coverages and providing such bond as specified with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof; or if, in the event of the failure of the PRINCIPAL to enter into such contract and to give the specified bond, the PRINCIPAL pays to the Department the difference not to exceed the penalty hereof between the amount specified in the bid proposal and such larger amount for which the Department may contract with another party to perform the work covered by said bid proposal, then this obligation shall be null and void, otherwise, it shall remain in full force and effect.

IN THE EVENT the Department determines the PRINCIPAL has failed to comply with any requirement as set forth in the preceding paragraph, then Surety shall pay the penal sum to the Department within fifteen (15) days of written demand therefor. If Surety does not make full payment within such period of time, the Department may bring an action to collect the amount owed. Surety is liable to the Department for all its expenses, including attorney's fees, incurred in any litigation in which it prevails either in whole or in part.

In TESTIMONY WHEREOF, the said PRINCIPAL has caused this instrument to be signed by its officer _____ day of _____ A.D., _____

In TESTIMONY WHEREOF, the said SURETY has caused this instrument to be signed by its officer _____ day of _____ A.D., _____

(Company Name)

(Company Name)

By _____
(Signature and Title)

By _____
(Signature of Attorney-in-Fact)

Notary for PRINCIPAL

Notary for SURETY

STATE OF _____
COUNTY OF _____

STATE OF _____
COUNTY OF _____

Signed and attested before me on _____ (date)

Signed and attested before me on _____ (date)

by _____
(Name of Notary Public)

by _____
(Name of Notary Public)

(Seal) _____
(Signature of Notary Public)

(Seal) _____
(Signature of Notary Public)

(Date Commission Expires)

(Date Commission Expires)

In lieu of completing the above section of the Annual Proposal Bid Bond form, the Principal may file an Electronic Bid Bond. By signing the proposal(s) the Principal is ensuring the identified electronic bid bond has been executed and the Principal and Surety are firmly bound unto the State of Illinois under the conditions of the bid bond as shown above.

Electronic Bid Bond ID #	Company/Bidder Name	Signature and Title
--------------------------	---------------------	---------------------

This bond may be terminated, at Surety's request, upon giving not less than thirty (30) days prior written notice of the cancellation/termination of the bond. Said written notice shall be issued to the Illinois Department of Transportation, Chief Contracts Official, 2300 South Dirksen Parkway, Springfield, Illinois, 62764, and shall be served in person, by receipted courier delivery or certified or registered mail, return receipt requested. Said notice period shall commence on the first calendar day following the Department's receipt of written cancellation/termination notice. Surety shall remain firmly bound to all obligations herein for proposals submitted prior to the cancellation/termination. Surety shall be released and discharged from any obligation(s) for proposals submitted for any letting or date after the effective date of cancellation/termination.



Item No. _____

Letting Date _____

KNOW ALL PERSONS BY THESE PRESENTS, That We _____

as PRINCIPAL, and _____

as SURETY, and held jointly, severally and firmly bound unto the STATE OF ILLINOIS in the penal sum of 5 percent of the total bid price, or for the amount specified in the bid proposal under "Proposal Guaranty" in effect on the date of the Invitation for Bids, whichever is the lesser sum, well and truly to be paid unto said STATE OF ILLINOIS, for the payment of which we bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH that whereas, the PRINCIPAL has submitted a bid proposal to the STATE OF ILLINOIS, acting through the Department of Transportation, for the improvement designated by the Transportation Bulletin Item Number and Letting Date indicated above.

NOW, THEREFORE, if the Department shall accept the bid proposal of the PRINCIPAL; and if the PRINCIPAL shall, within the time and as specified in the bidding and contract documents; and if, after award by the Department, the PRINCIPAL shall enter into a contract in accordance with the terms of the bidding and contract documents including evidence of the required insurance coverages and providing such bond as specified with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof; or if, in the event of the failure of the PRINCIPAL to enter into such contract and to give the specified bond, the PRINCIPAL pays to the Department the difference not to exceed the penalty hereof between the amount specified in the bid proposal and such larger amount for which the Department may contract with another party to perform the work covered by said bid proposal, then this obligation shall be null and void, otherwise, it shall remain in full force and effect.

IN THE EVENT the Department determines the PRINCIPAL has failed to comply with any requirement as set forth in the preceding paragraph, then Surety shall pay the penal sum to the Department within fifteen (15) days of written demand therefor. If Surety does not make full payment within such period of time, the Department may bring an action to collect the amount owed. Surety is liable to the Department for all its expenses, including attorney's fees, incurred in any litigation in which it prevails either in whole or in part.

In TESTIMONY WHEREOF, the said PRINCIPAL has caused this instrument to be signed by its officer _____ day of _____ A.D., _____

In TESTIMONY WHEREOF, the said SURETY has caused this instrument to be signed by its officer _____ day of _____ A.D., _____

(Company Name)

(Company Name)

By _____
(Signature and Title)

By _____
(Signature of Attorney-in-Fact)

Notary for PRINCIPAL

Notary for SURETY

STATE OF _____
COUNTY OF _____

STATE OF _____
COUNTY OF _____

Signed and attested before me on _____ (date)
by _____

Signed and attested before me on _____ (date)
by _____

(Name of Notary Public)

(Name of Notary Public)

(Seal) _____
(Signature of Notary Public)

(Seal) _____
(Signature of Notary Public)

(Date Commission Expires)

(Date Commission Expires)

In lieu of completing the above section of the Proposal Bid Bond form, the Principal may file an Electronic Bid Bond. By signing the proposal the Principal is ensuring the identified electronic bid bond has been executed and the Principal and Surety are firmly bound unto the State of Illinois under the conditions of the bid bond as shown above.

Electronic Bid Bond ID # _____ Company/Bidder Name _____ Signature and Title _____

(1) Policy

It is public policy that disadvantageded businesses as defined in 49 CFR Part 26 and the Special Provision shall have the maximum opportunity to participate in the performance of contracts financed in whole or in part with Federal or State funds. Consequently the requirements of 49 CFR Part 26 apply to this contract.

(2) Obligation

The contractor agrees to ensure that disadvantageded businesses as defined in 49 CFR Part 26 and the Special Provision have the maximum opportunity to participate in the performance of contracts or subcontracts financed in whole or in part with Federal or State funds. The contractor shall take all necessary and reasonable steps in accordance with 49 CFR Part 26 and the Special Provision to ensure that said businesses have the maximum opportunity to compete for and perform under this contract. The contractor shall not discriminate on the basis of race, color, national origin or sex in the award and performance of contracts.

(3) Project and Bid Identification

Complete the following information concerning the project and bid:

Route _____	Total Bid _____
Section _____	Contract DBE Goal _____ (Percent) _____ (Dollar Amount)
Project _____	
County _____	
Letting Date _____	
Contract No. _____	
Letting Item No. _____	

(4) Assurance

I, acting in my capacity as an officer of the undersigned bidder (or bidders if a joint venture), hereby assure the Department that on this project my company : (check one)

Meets or exceeds contract award goals and has provided documented participation as follows:
Disadvantaged Business Participation _____ percent

Attached are the signed participation statements, forms SBE 2025, required by the Special Provision evidencing availability and use of each business participating in this plan and assuring that each business will perform a commercially useful function in the work of the contract.

Failed to meet contract award goals and has included good faith effort documentation to meet the goals and that my company has provided participation as follows:

Disadvantaged Business Participation _____ percent

The contract goals should be accordingly modified or waived. Attached is all information required by the Special Provision in support of this request including good faith effort. Also attached are the signed participation statements, forms SBE 2025, required by the Special Provision evidencing availability and use of each business participating in this plan and assuring that each business will perform a commercially useful function in the work of the contract.

Company

By _____

Title _____

Date _____

The "as read" Low Bidder is required to comply with the Special Provision.

Submit only one utilization plan for each project. The utilization plan shall be submitted in accordance with the special provision.

Bureau of Small Business Enterprises **Local Let Projects**
2300 South Dirksen Parkway Submit forms to the
Springfield, Illinois 62764 Local Agency

The Department of Transportation is requesting disclosure of information that is necessary to accomplish the purpose as outlined under State and Federal law. Disclosure of this information is **REQUIRED**. Failure to provide any information will result in the contract not being awarded. This form has been approved by the State Forms Manager Center.

PROPOSAL ENVELOPE



PROPOSALS

for construction work advertised for bids by the
Illinois Department of Transportation

Item No.	Item No.	Item No.

Submitted By:

Name:
Address:
Phone No.

Bidders should use an IDOT proposal envelope or affix this form to the front of a 10" x 13" envelope for the submittal of bids. If proposals are mailed, they should be enclosed in a second or outer envelope addressed to:

Engineer of Design and Environment - Room 326
Illinois Department of Transportation
2300 South Dirksen Parkway
Springfield, Illinois 62764

NOTICE

Individual bids, including Bid Bond and/or supplemental information if required, should be securely stapled.

CONTRACTOR OFFICE COPY OF CONTRACT SPECIFICATIONS

NOTICE

None of the following material needs to be returned with the bid package unless the special provisions require documentation and/or other information to be submitted.

**Contract No. 60W29
COOK County
Section 2013-011R
Project ACNHPP-0290(200)
Route FAI 290
District 1 Construction Funds**



Illinois Department of Transportation

SUBCONTRACTOR DOCUMENTATION

Public Acts 96-0795, 96-0920, and 97-0895 enacted substantial changes to the provisions of the Code (30 ILCS 500). Among the changes are provisions affecting subcontractors. The Contractor awarded this contract will be required as a material condition of the contract to implement and enforce the contract requirements applicable to subcontractors that entered into a contractual agreement with a total value of \$50,000 or more with a person or entity who has a contract subject to the Code and approved in accordance with article 108.01 of the Standard Specifications for Road and Bridge Construction.

If the Contractor seeks approval of subcontractors to perform a portion of the work, and approval is granted by the Department, the Contractor shall provide a copy of the subcontract to the Illinois Department of Transportation's CPO upon request within 15 calendar days after execution of the subcontract.

Financial disclosures required pursuant to Sec. 50-35 of the Code must be submitted for all applicable subcontractors. The subcontract shall contain the certifications required to be made by subcontractors pursuant to Article 50 of the Code. This Notice to Bidders includes a document incorporating all required subcontractor certifications and disclosures for use by the Contractor in compliance with this mandate. The document is entitled State Required Ethical Standards Governing Subcontractors.

RETURN WITH SUBCONTRACT

STATE ETHICAL STANDARDS GOVERNING SUBCONTRACTORS

Article 50 of the Code establishes the duty of all State CPOs, SPOs, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

The certifications hereinafter made by the subcontractor are each a material representation of fact upon which reliance is placed should the Department approve the subcontractor. The CPO may terminate or void the contract approval if it is later determined that the bidder or subcontractor rendered a false or erroneous certification. If a false certification is made by a subcontractor the contractor's submitted bid and the executed contract may not be declared void unless the contractor refuses to terminate the subcontract upon the State's request after a finding that the subcontractor's certification was false.

Section 50-2 of the Code provides that every person that has entered into a multi-year contract and every subcontractor with a multi-year subcontract shall certify, by July 1 of each fiscal year covered by the contract after the initial fiscal year, to the responsible CPO whether it continues to satisfy the requirements of Article 50 pertaining to the eligibility for a contract award. If a contractor or subcontractor is not able to truthfully certify that it continues to meet all requirements, it shall provide with its certification a detailed explanation of the circumstances leading to the change in certification status. A contractor or subcontractor that makes a false statement material to any given certification required under Article 50 is, in addition to any other penalties or consequences prescribed by law, subject to liability under the Whistleblower Reward and Protection Act for submission of a false claim.

A. Bribery

Section 50-5. Bribery.

(a) Prohibition. No person or business shall be awarded a contract or subcontract under this Code who:

(1) has been convicted under the laws of Illinois or any other state of bribery or attempting to bribe an officer or employee of the State of Illinois or any other state in that officer's or employee's official capacity; or

(2) has made an admission of guilt of that conduct that is a matter of record but has not been prosecuted for that conduct.

(b) Businesses. No business shall be barred from contracting with any unit of State or local government, or subcontracting under such a contract, as a result of a conviction under this Section of any employee or agent of the business if the employee or agent is no longer employed by the business and:

(1) the business has been finally adjudicated not guilty; or

(2) the business demonstrates to the governmental entity with which it seeks to contract, or which is signatory to the contract to which the subcontract relates, and that entity finds that the commission of the offense was not authorized, requested, commanded, or performed by a director, officer, or high managerial agent on behalf of the business as provided in paragraph (2) of subsection (a) of Section 5-4 of the Criminal Code of 2012.

(c) Conduct on behalf of business. For purposes of this Section, when an official, agent, or employee of a business committed the bribery or attempted bribery on behalf of the business and in accordance with the direction or authorization of a responsible official of the business, the business shall be chargeable with the conduct.

(d) Certification. Every bid submitted to and contract executed by the State, and every subcontract subject to Section 20-120 of the Code shall contain a certification by the contractor or the subcontractor, respectively, that the contractor or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the CPO may declare the related contract void if any certifications required by this Section are false. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

The contractor or subcontractor certifies that it is not barred from being awarded a contract under Section 50.5.

B. Felons

Section 50-10. Felons.

(a) Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any State agency, or enter into a subcontract, from the date of conviction until 5 years after the date of completion of the sentence for that felony, unless no person held responsible by a prosecutorial office for the facts upon which the conviction was based continues to have any involvement with the business.

(b) Certification. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Code shall contain a certification by the bidder or contractor or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the CPO may declare the related contract void if any of the certifications required by this Section are false.

RETURN WITH SUBCONTRACT

C. Debt Delinquency

Section 50-11 and 50-12. Debt Delinquency.

The contractor or bidder or subcontractor, respectively, certifies that it, or any affiliate, is not barred from being awarded a contract or subcontract under the Code. Section 50-11 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it knows or should know that it, or any affiliate, is delinquent in the payment of any debt to the State as defined by the Debt Collection Board. Section 50-12 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it, or any affiliate, has failed to collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act. The bidder or contractor or subcontractor, respectively, further acknowledges that the CPO may declare the related contract void if this certification is false or if the bidder, contractor, or subcontractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

D. Prohibited Bidders, Contractors and Subcontractors

Section 50-10.5 and 50-60(c). Prohibited bidders, contractors and subcontractors.

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-10.5 that no officer, director, partner or other managerial agent of the contracting business has been convicted of a felony under the Sarbanes-Oxley Act of 2002 or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953 or if in violation of Subsection (c) for a period of five years from the date of conviction. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Code shall contain a certification by the bidder, contractor, or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the CPO shall declare the related contract void if any of the certifications completed pursuant to this Section are false.

E. Section 42 of the Environmental Protection Act

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-14 that the bidder, contractor, or subcontractor, is not barred from being awarded a contract or entering into a subcontract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency, or entering into any subcontract, that is subject to the Code by a person or business found by a court or the Pollution Control Board to have committed a willful or knowing violation of Section 42 of the Environmental Protection Act for a period of five years from the date of the order. The bidder or contractor or subcontractor, respectively, acknowledges that the CPO may declare the contract void if this certification is false.

The undersigned, on behalf of the subcontracting company, has read and understands the above certifications and makes the certifications as required by law.

Name of Subcontracting Company

Authorized Officer

Date

RETURN WITH SUBCONTRACT
SUBCONTRACTOR DISCLOSURES

I. DISCLOSURES

- A.** The disclosures hereinafter made by the subcontractor are each a material representation of fact upon which reliance is placed. The subcontractor further certifies that the Department has received the disclosure forms for each subcontract.

The CPO may void the bid, contract, or subcontract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Code. Furthermore, the CPO may void the contract.

B. Financial Interests and Conflicts of Interest

1. Section 50-35 of the Code provides that all subcontracts with a total value of \$50,000 or more, from subcontractors identified in Section 20-120 of the Code, shall be accompanied by disclosure of the financial interests of the subcontractor. This disclosed information for the subcontractor, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the Prime Contractor's contract. Furthermore, pursuant to this Section, the Procurement Policy Board may recommend to allow or void a contract or subcontract based on a potential conflict of interest.

The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the subcontracting entity or its parent entity, whichever is less, unless the subcontractor is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a subcontractor is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form.

The current annual salary of the Governor is \$177,412.00.

In addition, all disclosures shall indicate any other current or pending contracts, subcontracts, proposals, leases, or other ongoing procurement relationships the subcontracting entity has with any other unit of state government and shall clearly identify the unit and the contract, subcontract, proposal, lease, or other relationship.

2. Disclosure Forms. Disclosure Form A is attached for use concerning the individuals meeting the above ownership or distributive share requirements. A separate Disclosure Form A must be submitted with the bid for each individual meeting the above requirements. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies and a total ownership certification. **The forms must be included with each bid.**

C. Disclosure Form Instructions

Form A Instructions for Financial Information & Potential Conflicts of Interest

If the subcontractor is a publicly traded entity subject to Federal 10K reporting, the 10K Report may be submitted to meet the requirements of Form A. If a subcontractor is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. If a subcontractor is not subject to Federal 10K reporting, the subcontractor must determine if any individuals are required by law to complete a financial disclosure form. To do this, the subcontractor should answer each of the following questions. A "YES" answer indicates Form A must be completed. If the answer to each of the following questions is "NO", then the **NOT APPLICABLE STATEMENT** on the second page of Form A must be signed and dated by a person that is authorized to execute contracts for the subcontracting company. Note: These questions are for assistance only and are not required to be completed.

1. Does anyone in your organization have a direct or beneficial ownership share of greater than 5% of the bidding entity or parent entity? YES ___ NO ___
2. Does anyone in your organization have a direct or beneficial ownership share of less than 5%, but which has a value greater than 60% of the annual salary of the Governor? YES ___ NO ___
3. Does anyone in your organization receive more than 60% of the annual salary of the Governor of the subcontracting entity's or parent entity's distributive income? YES ___ NO ___

(Note: Distributive income is, for these purposes, any type of distribution of profits. An annual salary is not distributive income.)

4. Does anyone in your organization receive greater than 5% of the subcontracting entity's or parent entity's total distributive income, but which is less than 60% of the annual salary of the Governor? YES ___ NO ___

(Note: Only one set of forms needs to be completed per person per subcontract even if a specific individual would require a yes answer to more than one question.)

A "YES" answer to any of these questions requires the completion of Form A. The subcontractor must determine each individual in the subcontracting entity or the subcontracting entity's parent company that would cause the questions to be answered "Yes". Each form must be signed and dated by a person that is authorized to execute contracts for your organization. **Photocopied or stamped signatures are not acceptable.** The person signing can be, but does not have to be, the person for which the form is being completed. The subcontractor is responsible for the accuracy of any information provided.

If the answer to each of the above questions is "NO", then the **NOT APPLICABLE STATEMENT** on page 2 of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

RETURN WITH SUBCONTRACT

Form B: Instructions for Identifying Other Contracts & Procurement Related Information

Disclosure Form B must be completed for each subcontract submitted by the subcontracting entity. *Note: Checking the NOT APPLICABLE STATEMENT on Form A does not allow the subcontractor to ignore Form B. Form B must be completed, checked, and dated or the subcontract will not be approved.*

The Subcontractor shall identify, by checking Yes or No on Form B, whether it has any pending contracts, subcontracts, leases, bids, proposals, or other ongoing procurement relationship with any other (non-IDOT) State of Illinois agency. If "No" is checked, the subcontractor only needs to complete the check box on the bottom of Form B. If "Yes" is checked, the subcontractor must list all non-IDOT State of Illinois agency pending contracts, subcontracts, leases, bids, proposals, and other ongoing procurement relationships. These items may be listed on Form B or on an attached sheet(s). Contracts with cities, counties, villages, etc. are not considered State of Illinois agency contracts and are not to be included. Contracts or subcontracts with other State of Illinois agencies such as the Department of Natural Resources or the Capital Development Board must be included.

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form A Subcontractor: Financial Information & Potential Conflicts of Interest Disclosure

Subcontractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Code (30 ILCS 500). Subcontractors desiring to enter into a subcontract of a State of Illinois contract must disclose the financial information and potential conflict of interest information as specified in this Disclosure Form.

The current annual salary of the Governor is \$177,412.00.

DISCLOSURE OF FINANCIAL INFORMATION

1. Disclosure of Financial Information. The individual named below has an interest in the SUBCONTRACTOR (or its parent) in terms of ownership or distributive income share in excess of 5%, or an interest which has a value of more than 60% of the annual salary of the Governor.

FOR INDIVIDUAL (type or print information) NAME: ADDRESS Type of ownership/distributable income share: stock sole proprietorship Partnership other: (explain on separate sheet): % or \$ value of ownership/distributable income share:

2. Disclosure of Potential Conflicts of Interest. Check "Yes" or "No" to indicate which, if any, of the following potential conflict of interest relationships apply. If the answer to any question is "Yes", please attach additional pages and describe.

(a) State employment, currently or in the previous 3 years, including contractual employment of services. Yes ___ No ___

If your answer is yes, please answer each of the following questions.

1. Are you currently an officer or employee of either the Capitol Development Board or the Illinois State Toll Highway Authority? Yes ___ No ___

2. Are you currently appointed to or employed by any agency of the State of Illinois? If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, provide the name the State agency for which you are employed and your annual salary.

RETURN WITH SUBCONTRACT

3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 100% of the annual salary of the Governor?
Yes ___ No ___

4. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor?
Yes ___ No ___

(b) State employment of spouse, father, mother, son, or daughter, including contractual employment services in the previous 2 years.

Yes ___ No ___

If your answer is yes, please answer each of the following questions.

1. Is your spouse or any minor children currently an officer or employee of the Capitol Development Board or the Illinois State Toll Highway Authority?
Yes ___ No ___

2. Is your spouse or any minor children currently appointed to or employed by any agency of the State of Illinois? If your spouse or minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, provide the name of your spouse and/or minor children, the name of the State agency for which he/she is employed and his/her annual salary. _____

3. If your spouse or any minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 100% of the annual salary of the Governor?
Yes ___ No ___

4. If your spouse or any minor children are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor?
Yes ___ No ___

(c) Elective status; the holding of elective office of the State of Illinois, the government of the United States, any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois currently or in the previous 3 years.
Yes ___ No ___

(d) Relationship to anyone holding elective office currently or in the previous 2 years; spouse, father, mother, son, or daughter.
Yes ___ No ___

(e) Appointive office; the holding of any appointive government office of the State of Illinois, the United States of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of the expenses incurred in the discharge of that office currently or in the previous 3 years.
Yes ___ No ___

(f) Relationship to anyone holding appointive office currently or in the previous 2 years; spouse, father, mother, son, or daughter.
Yes ___ No ___

(g) Employment, currently or in the previous 3 years, as or by any registered lobbyist of the State government.
Yes ___ No ___

RETURN WITH SUBCONTRACT

(h) Relationship to anyone who is or was a registered lobbyist in the previous 2 years; spouse, father, mother, son, or daughter. Yes ___ No ___

(i) Compensated employment, currently or in the previous 3 years, by any registered election or reelection committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

(j) Relationship to anyone; spouse, father, mother, son, or daughter; who was a compensated employee in the last 2 years by any registered election or re-election committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

3 Communication Disclosure.

Disclose the name and address of each lobbyist and other agent of the bidder or offeror who is not identified in Section 2 of this form, who is has communicated, is communicating, or may communicate with any State officer or employee concerning the bid or offer. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the process and throughout the term of the contract. If no person is identified, enter "None" on the line below:

Name and address of person(s): _____

RETURN WITH SUBCONTRACT

4. Debarment Disclosure. For each of the persons identified under Sections 2 and 3 of this form, disclose whether any of the following has occurred within the previous 10 years: debarment from contracting with any governmental entity; professional licensure discipline; bankruptcies; adverse civil judgments and administrative findings; and criminal felony convictions. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the procurement process and term of the contract. If no person is identified, enter "None" on the line below:

Name of person(s): _____

Nature of disclosure: _____

APPLICABLE STATEMENT

This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page. Under penalty of perjury, I certify the contents of this disclosure to be true and accurate to the best of my knowledge.

Completed by: _____ Date _____
Signature of Individual or Authorized Officer

NOT APPLICABLE STATEMENT

Under penalty of perjury, I have determined that no individuals associated with this organization meet the criteria that would require the completion of this Form A.

This Disclosure Form A is submitted on behalf of the SUBCONTRACTOR listed on the previous page.

_____ Date _____
Signature of Authorized Officer

RETURN WITH SUBCONTRACT

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form B
Subcontractor: Other Contracts & Financial Related Information Disclosure

Form with fields: Subcontractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Code (30 ILCS 500). This information shall become part of the publicly available contract file.

DISCLOSURE OF OTHER CONTRACTS, SUBCONTRACTS, AND PROCUREMENT RELATED INFORMATION

1. Identifying Other Contracts & Procurement Related Information. The SUBCONTRACTOR shall identify whether it has any pending contracts, subcontracts, including leases, bids, proposals, or other ongoing procurement relationship with any other State of Illinois agency: Yes ___ No ___

If "No" is checked, the subcontractor only needs to complete the signature box on the bottom of this page.

2. If "Yes" is checked. Identify each such relationship by showing State of Illinois agency name and other descriptive information such as bid or project number (attach additional pages as necessary). SEE DISCLOSURE FORM INSTRUCTIONS:

THE FOLLOWING STATEMENT MUST BE CHECKED

Signature box with fields for Signature of Authorized Officer and Date

OWNERSHIP CERTIFICATION

Please certify that the following statement is true if the individuals for all submitted Form A disclosures do not total 100% of ownership

Any remaining ownership interest is held by individuals receiving less than \$106,447.20 of the bidding entity's or parent entity's distributive income or holding less than a 5% ownership interest.

Yes No N/A (Form A disclosure(s) established 100% ownership)



1. **TIME AND PLACE OF OPENING BIDS.** Sealed proposals for the improvement described herein will be received by the Department of Transportation. Electronic bids are to be submitted to the electronic bidding system (ics-Integrated Contractors Exchange). Paper-based bids are to be submitted to the Chief Procurement Officer for the Department of Transportation in care of the Chief Contracts Official at the Harry R. Hanley Building, 2300 South Dirksen Parkway, in Springfield, Illinois until 10:00 o'clock a.m. February 28, 2014. All bids will be gathered, sorted, publicly opened and read in the auditorium at the Department of Transportation's Harry R. Hanley Building shortly after the 10:00 a.m. cut off time.
2. **DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60W29
COOK County
Section 2013-011R
Project ACNHPP-0290(200)
Route FAI 290
District 1 Construction Funds**

Bridge replacement, roadway reconstruction, lighting and CTA station rehabilitation on Peoria Street Bridge (SN 016-1708) at I-290/Congress Parkway (Circle Interchange) located in Chicago.

3. **INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.

(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
4. **AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to readvertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Ann L. Schneider,
Secretary

INDEX
 FOR
 SUPPLEMENTAL SPECIFICATIONS
 AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2014

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS, frequently used RECURRING SPECIAL PROVISIONS, and LOCAL ROADS AND STREETS RECURRING SPECIAL PROVISIONS.

ERRATA Standard Specifications for Road and Bridge Construction (Adopted 1-1-12) (Revised 1-1-14)

SUPPLEMENTAL SPECIFICATIONS

Std. Spec. Sec.	Page No.
101 Definition of Terms	1
102 Advertisement, Bidding, Award, and Contract Execution	2
105 Control of Work	3
106 Control of Materials	5
107 Legal Regulations and Responsibility to Public	6
108 Prosecution and Progress	14
109 Measurement and Payment	15
202 Earth and Rock Excavation	17
211 Topsoil and Compost	18
253 Planting Woody Plants	19
280 Temporary Erosion and Sediment Control	21
312 Stabilized Subbase	22
406 Hot-Mix Asphalt Binder and Surface Course	23
407 Hot-Mix Asphalt Pavement (Full-Depth)	26
420 Portland Cement Concrete Pavement	30
424 Portland Cement Concrete Sidewalk	32
440 Removal of Existing Pavement and Appurtenances	33
503 Concrete Structures	34
504 Precast Concrete Structures	37
506 Cleaning and Painting New Steel Structures	38
512 Piling	39
516 Drilled Shafts	40
521 Bearings	41
540 Box Culverts	42
588 Bridge Relief Joint System	43
589 Elastic Joint Sealer	45
602 Catch Basin, Manhole, Inlet, Drainage Structure, and Valve Vault Construction, Adjustment, and Reconstruction	46
603 Adjusting Frames and Grates of Drainage and Utility Structures	47
606 Concrete Gutter, Curb, Median, and Paved Ditch	49
610 Shoulder Inlets with Curb	50
639 Precast Prestressed Concrete Sight Screen	51
642 Shoulder Rumble Strips	52
643 Impact Attenuators	53
644 High Tension Cable Median Barrier	55
701 Work Zone Traffic Control and Protection	57
706 Impact Attenuators, Temporary	60
707 Movable Traffic Barrier	63
708 Temporary Water Filled Barrier	65
730 Wood Sign Support	67
780 Pavement Striping	68
860 Master Controller	73
1001 Cement	74
1003 Fine Aggregates	75
1004 Coarse Aggregates	77
1006 Metals	81
1011 Mineral Filler	83
1017 Packaged, Dry, Combined Materials for Mortar	84

FAI Route 290 (I-290)
Project ACNHPP-0290(200)
Section 2013-011R
Cook County
Contract 60W29

1018	Packaged Rapid Hardening Mortar or Concrete	85
1019	Controlled Low-Strength Material	86
1020	Portland Cement Concrete	87
1024	Grout and Nonshrink Grout	126
1030	Hot-Mix Asphalt	127
1040	Drain Pipe, Tile, Drainage Mat, and Wall Drain	132
1042	Precast Concrete Products	133
1070	Foundation and Breakaway Devices	134
1073	Controller	135
1081	Materials for Planting	136
1082	Prefomed Bearing Pads	137
1083	Elastomeric Bearings	138
1095	Pavement Markings	139
1101	General Equipment	142
1102	Hot-Mix Asphalt Equipment	144
1105	Pavement Marking Equipment	146
1106	Work Zone Traffic Control Devices	147

RECURRING SPECIAL PROVISIONS

The following RECURRING SPECIAL PROVISIONS indicated by an "X" are applicable to this contract and are included by reference:

<u>CHECK SHEET #</u>		<u>PAGE NO.</u>
1	X Additional State Requirements for Federal-Aid Construction Contracts (Eff. 2-1-69) (Rev. 1-1-10)	149
2	X Subletting of Contracts (Federal-Aid Contracts) (Eff. 1-1-88) (Rev. 5-1-93)	152
3	X EEO (Eff. 7-21-78) (Rev. 11-18-80)	153
4	Specific Equal Employment Opportunity Responsibilities Non Federal-Aid Contracts (Eff. 3-20-69) (Rev. 1-1-94) ...	163
5	Required Provisions - State Contracts (Eff. 4-1-65) (Rev. 1-1-13)	168
6	Asbestos Bearing Pad Removal (Eff. 11-1-03)	173
7	Asbestos Waterproofing Membrane and Asbestos Hot-Mix Asphalt Surface Removal (Eff. 6-1-89) (Rev. 1-1-09) ...	174
8	Haul Road Stream Crossings, Other Temporary Stream Crossings, and In-Stream Work Pads (Eff. 1-2-92) (Rev. 1-1-98)	175
9	Construction Layout Stakes Except for Bridges (Eff. 1-1-99) (Rev. 1-1-07)	176
10	X Construction Layout Stakes (Eff. 5-1-93) (Rev. 1-1-07)	179
11	Use of Geotextile Fabric for Railroad Crossing (Eff. 1-1-95) (Rev. 1-1-07)	182
12	Subsealing of Concrete Pavements (Eff. 11-1-84) (Rev. 1-1-07)	184
13	Hot-Mix Asphalt Surface Correction (Eff. 11-1-87) (Rev. 1-1-09)	188
14	Pavement and Shoulder Resurfacing (Eff. 2-1-00) (Rev. 1-1-09)	190
15	PCC Partial Depth Hot-Mix Asphalt Patching (Eff. 1-1-98) (Rev. 1-1-07)	191
16	Patching with Hot-Mix Asphalt Overlay Removal (Eff. 10-1-95) (Rev. 1-1-07)	193
17	Polymer Concrete (Eff. 8-1-95) (Rev. 1-1-08)	194
18	PVC Pipeliner (Eff. 4-1-04) (Rev. 1-1-07)	196
19	X Pipe Underdrains (Eff. 9-9-87) (Rev. 1-1-07)	197
20	X Guardrail and Barrier Wall Delineation (Eff. 12-15-93) (Rev. 1-1-12)	198
21	Bicycle Racks (Eff. 4-1-94) (Rev. 1-1-12)	202
22	Temporary Modular Glare Screen System (Eff. 1-1-00) (Rev. 1-1-07)	204
23	Temporary Portable Bridge Traffic Signals (Eff. 8-1-03) (Rev. 1-1-07)	206
24	X Work Zone Public Information Signs (Eff. 9-1-02) (Rev. 1-1-07)	208
25	X Night Time Inspection of Roadway Lighting (Eff. 5-1-96)	209
26	English Substitution of Metric Bolts (Eff. 7-1-96)	210
27	English Substitution of Metric Reinforcement Bars (Eff. 4-1-96) (Rev. 1-1-03)	211
28	Calcium Chloride Accelerator for Portland Cement Concrete (Eff. 1-1-01) (Rev. 1-1-13)	212
29	Portland Cement Concrete Inlay or Overlay for Pavements (Eff. 11-1-08) (Rev. 1-1-13)	213
30	Quality Control of Concrete Mixtures at the Plant (Eff. 8-1-00) (Rev. 1-1-14)	216
31	X Quality Control/Quality Assurance of Concrete Mixtures (Eff. 4-1-92) (Rev. 1-1-14)	224
32	Digital Terrain Modeling for Earthwork Calculations (Eff. 4-1-07)	240
33	X Pavement Marking Removal (Eff. 4-1-09)	242
34	Preventive Maintenance – Bituminous Surface Treatment (Eff. 1-1-09) (Rev. 1-1-12)	243
35	Preventive Maintenance – Cape Seal (Eff. 1-1-09) (Rev. 1-1-12)	249
36	Preventive Maintenance – Micro-Surfacing (Eff. 1-1-09) (Rev. 1-1-12)	264
37	Preventive Maintenance – Slurry Seal (Eff. 1-1-09) (Rev. 1-1-12)	275
38	Temporary Raised Pavement Markers (Eff. 1-1-09) (Rev. 1-1-14)	285
39	Restoring Bridge Approach Pavements Using High-Density Foam (Eff. 1-1-09) (Rev. 1-1-12)	286

TABLE OF CONTENTS

LOCATION OF PROJECT	1
DESCRIPTION OF PROJECT	1
SOILS INFORMATION	2
CONTRACTOR COOPERATION	2
ADDITIONAL INSURED	3
PROGRESS SCHEDULE	3
SUBMITTALS	9
STAGING AND INTERCHANGE RESTRICTIONS	10
WINTER WORK.....	13
CTA FLAGGING AND COORDINATION.....	13
MAINTENANCE OF ROADWAYS.....	32
STATUS OF UTILITIES TO BE ADJUSTED	32
RESTRICTION ON WORKING DAYS AFTER A COMPLETION DATE	37
FAILURE TO COMPLETE THE WORK ON TIME.....	37
COMPLETION DATE PLUS WORKING DAYS.....	38
TRAFFIC CONTROL AND PROTECTION (ARTERIALS).....	38
TRAFFIC CONTROL PLAN.....	39
ADJUSTMENTS AND RECONSTRUCTIONS	40
AGGREGATE FOR CONCRETE BARRIER (D-1)	41
AGGREGATE SUBGRADE IMPROVEMENT (D-1)	41
COARSE AGGREGATE FOR BACKFILL, TRENCH BACKFILL AND BEDDING (D-1)	43
DRAINAGE AND INLET PROTECTION UNDER TRAFFIC (DISTRICT 1).....	44
EMBANKMENT 1.....	45
FINE AGGREGATE FOR HOT-MIX ASPHALT (HMA) (D-1)	47
FRICTION SURFACE AGGREGATE (D-1).....	48
GROUND TIRE RUBBER (GTR) MODIFIED ASPHALT BINDER (D-1)	50
HEAT OF HYDRATION CONTROL FOR CONCRETE STRUCTURES (D-1)	52
HMA MIXTURE DESIGN REQUIREMENTS (D-1).....	52
PUBLIC CONVENIENCE AND SAFETY (D-1).....	57
RECLAIMED ASPHALT PAVEMENT AND RECLAIMED ASPHALT SHINGLES (D-1).....	57
GENERAL ELECTRICAL REQUIREMENTS.....	68
LUMINAIRE	73
UNDERGROUND RACEWAYS.....	79
UNIT DUCT.....	80
WIRE AND CABLE	81

KEEPING THE EXPRESSWAY OPEN TO TRAFFIC	82
FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC.....	85
TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS).....	85
TRAFFIC CONTROL SURVEILLANCE, EXPRESSWAYS	89
TEMPORARY INFORMATION SIGNING.....	89
TRAFFIC CONTROL FOR WORK ZONE AREAS	92
SIGN SHOP DRAWING SUBMITTAL	92
TRAFFIC SURVEILLANCE. – GENERAL (TSC T 400#02)	92
ELECTRIC CABLE NO. 19 - 6 CONDUCTORS OR 12 CONDUCTORS (TSC T 421#2)	99
HANDHOLE (TSC T 428#1)	101
CONCRETE BARRIER REMOVAL	102
REMOVAL OF EXISTING STRUCTURES	103
FORM LINER TEXTURED SURFACE	106
FILLING VALVE VAULTS.....	107
REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES.....	108
EXPOSED RACEWAYS	113
UNDERPASS LUMINAIRE, HPS, STAINLESS STEEL HOUSING.....	117
REMOVAL OF LIGHTING UNIT, SALVAGE	131
REMOVE EXISTING HANDHOLE.....	131
WEED CONTROL, PRE-EMERGENT GRANULAR HERBICIDE	132
MULCH	133
REMOVE TEMPORARY WOOD POLE	134
PILE EXTRACTION	134
REMOVAL OF ASBESTOS CEMENT CONDUIT.....	135
MAINTENANCE OF STREET LIGHTING SYSTEM (CITY OF CHICAGO).....	141
TELEVISION INSPECTION OF SEWER.....	145
REMOVE EXISTING CABLE.....	146
CABLE IN CONDUIT, TRIPLEX 2-1/C NO. 6 AND 1-1/C NO. 8 GROUND	147
CONCRETE BARRIER BASE (SPECIAL).....	148
DECORATIVE RAILING (PARAPET MOUNTED).....	148
CLEANING EXISTING SEWERS	150
CROSSHOLE SONIC LOGGING	151
TEMPORARY WOOD POLE, 60 FT., CLASS 4.....	156
CONSTRUCTION VIBRATION MONITORING	157
COMBINED SEWER REMOVAL.....	160
MAINTAINING ITS DURING CONSTRUCTION.....	161
UNDERGROUND CONDUIT, SCHEDULE 80 (CDOT).....	162

COMBINED SEWER (EXTRA STRENGTH VITRIFIED CLAY PIPE) (CDOT).....	163
COMBINED SEWER ADJACENT TO OR CROSSING WATER MAIN	164
COMBINATION CURB AND GUTTER TYPE B V.12 (CDOT)	165
SAND CUSHION, 4 INCH, (CDOT)	165
CLEAN MANHOLE OR HANDHOLE	166
CONCRETE CURB, TYPE B (SPECIAL) (CDOT).....	167
DETECTABLE WARNINGS (SPECIAL)	167
FOUNDATION REMOVAL.....	168
BRIDGE FENCE RAILING (SPECIAL)	169
TREE GRATES.....	172
WATER MAIN REMOVAL	174
INLETS (CITY OF CHICAGO)	174
CATCH BASINS (CITY OF CHICAGO)	175
DRAINAGE STRUCTURES TO BE RECONSTRUCTED (SPECIAL).....	176
FRAMES AND LIDS TO BE ADJUSTED (SPECIAL)	177
STEEL POSTS, SPECIAL	178
CONCRETE BARRIER WALL (SPECIAL)	181
CONCRETE BARRIER TRANSITION (SPECIAL).....	182
TEMPORARY CHAIN LINK FENCE	182
ENGINEER'S FIELD OFFICE TYPE A (SPECIAL)	183
REMOVE OVERHEAD SIGN STRUCTURE - WALKWAY.....	184
RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL	185
LIGHT POLE FOUNDATION, SPECIAL.....	185
CONCRETE FOUNDATION (SPECIAL)	186
BOLLARDS.....	187
APPROACH SLAB REMOVAL	189
WELDED WIRE FABRIC 6X6.....	189
STABILIZED CONSTRUCTION ENTRANCE.....	190
FENCE REMOVAL	190
MAINTENANCE OF LIGHTING SYSTEMS.....	191
TEMPORARY PAVEMENT	194
TEMPORARY SOIL RETENTION SYSTEM	195
SIPHON RECONSTRUCTION	197
TEMPORARY EPOXY PAVEMENT MARKING	202
RACKING CABLES IN MANHOLE OR HANDHOLE (CDOT)	203
GROUND ROD, 3/4" DIA. X 10.0'-0" LENGTH (CDOT)	203
ELECTRICAL MANHOLE, 3' X 4' X 4', 30" FRAME AND LID (CDOT).....	204

LIGHT POLE, ALUMINUM, 18 FT. M.H., 8 FT. DAVIT ARM.....	205
LIGHT POLE, ALUMINUM, 18 FT. M.H., 8 FT. DAVIT ARM - TWIN	205
REMOVAL OF ETU BOLLARD FOUNDATION.....	206
ROD AND CLEAN DUCT IN EXISTING CONDUIT SYSTEM(CDOT)	207
MAINTENANCE OF TRANSIT OPERATIONS (CTA)	208
CONCRETE (CTA)	208
DEMOLITION (CTA).....	209
STRUCTURAL STEEL AND METAL DECK (CTA)	209
STATION RENOVATION (CTA).....	210
ELEVATOR (CTA)	211
MECHANICAL AND PLUMBING (CTA)	211
ELECTRICAL AND COMMUNICATIONS (CTA).....	212
EARTHWORK, MICROPILES AND DRILLED SHAFTS (CTA).....	212
RELOCATION OF DUCT BANK (CTA)	213
BALLASTED TRACK CONSTRUCTION (CTA)	213
EXPLORATORY TRENCHING (CTA).....	214
SOIL RETENTION SYSTEM	215
HOT DIP GALVANIZING FOR STRUCTURAL STEEL	216
PRECAST CONCRETE DECK PANELS.....	221
BRIDGE DECK LATEX CONCRETE OVERLAY.....	227
APPENDIX A – CITY OF CHICAGO DEPARTMENT OF TRANSPORTATION DIVISION OF ELECTRICAL OPERATIONS	235
ELECTRICAL SPECIFICATION 1351	237
ELECTRICAL SPECIFICATION 1467	266
ELECTRICAL SPECIFICATION 1524	268
ELECTRICAL SPECIFICATION 1533	273
APPENDIX B – STORM WATER POLLUTION PREVENTION PLAN	282
APPENDIX C – CHICAGO TRANSIT AUTHORITY CTA STATION SPECIFICATIONS.....	296
PART 1 GENERAL.....	513
REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES.....	1207
DRAINAGE SYSTEM	1212
PIPE UNDERDRAINS FOR STRUCTURES	1213
COARSE AGGREGATE IN BRIDGE APPROACH SLABS/FOOTINGS (BDE)	1215
CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE).....	1216
DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (BDE).....	1218
GRANULAR MATERIALS (BDE).....	1228
HOT-MIX ASPHALT - DENSITY TESTING OF LONGITUDINAL JOINTS (BDE).....	1228
LRFD STORM SEWER BURIAL TABLES (BDE).....	1230

PAVEMENT MARKING FOR BIKE SYMBOL (BDE).....	1239
PAYROLLS AND PAYROLL RECORDS (BDE)	1240
PORTLAND CEMENT CONCRETE – CURING OF ABUTMENTS AND PIERS (BDE).....	1242
PORTLAND CEMENT CONCRETE EQUIPMENT (BDE).....	1242
PROGRESS PAYMENTS (BDE)	1242
QUALITY CONTROL/QUALITY ASSURANCE OF CONCRETE MIXTURES (BDE).....	1243
REINFORCEMENT BARS (BDE)	1244
REMOVAL AND DISPOSAL OF SURPLUS MATERIALS (BDE).....	1245
TRACKING THE USE OF PESTICIDES (BDE).....	1246
TRAFFIC CONTROL SETUP AND REMOVAL FREEWAY/EXPRESSWAY (BDE)	1246
TRAINING SPECIAL PROVISIONS (BDE)	1247
IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION (TPG)	1249
WARM MIX ASPHALT (BDE)	1251
WEEKLY DBE TRUCKING REPORTS (BDE).....	1255
STEEL COST ADJUSTMENT (BDE) (RETURN FORM WITH BID).....	1256
PROJECT LABOR AGREEMENT - QUARTERLY EMPLOYMENT REPORT	1260
PROJECT LABOR AGREEMENT	1261

STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction" adopted January 1, 2012, the latest edition of the "Manual of Uniform Traffic Control Devices for Streets and Highways, the "Manual of Test Procedures for Materials" in effect on the date of invitation for bids, and the Supplemental Specifications and Recurring Special Provisions indicated on the Check Sheets included herein which apply to and govern the construction of FAI Route 290 (I-290), Section 2013-011R, in Cook County, Contract: 60W29 in Cook County, and in case of conflict with any part or parts of said specifications, the said special provisions shall take precedence and shall govern.

LOCATION OF PROJECT

The project is located along Peoria Street from north of Harrison Street to south of Van Buren Street. The gross and net length of the project is 687.95 Feet (0.130 miles).

DESCRIPTION OF PROJECT

The work consists of the replacement of the Peoria Street Bridge (SN 016-1708) over Interstate 290 and the CTA Blue Line from Harrison Street to south of Van Buren Street. The work also includes rehabilitation of the University of Illinois at Chicago (UIC) – Street Blue Line CTA Station adjacent to the Peoria Street Bridge.

Work includes bridge reconstruction, roadway reconstruction, erosion control and protection, utility relocation of existing storm sewers, special waste excavation, temporary pavement for I-290, earth excavation and embankment, removal of existing improvements, new storm and combined sewers, curbs, pavements, sidewalks, pavement marking and signage, roadway lighting, concrete abutments, steel furnishing and erection, bridge deck and railings, traffic control and protection, urban enhancements and all incidental and collateral work necessary to complete the improvements as shown on the Plans and as described herein.

Rehabilitation of the UIC – Halsted Street Blue Line CTA Station includes demolition of the existing block station house on the bridge, renovation of the existing "Glassbox" adjacent to the west side of the bridge, installation of a new elevator west of the existing "Glassbox", construction of a new walkway to provide a closed link to the new elevator and replacement of the existing "Glassbox" roof. The renovated "Glassbox" will provide an area that will accommodate fare collection machines, turnstiles, exit gates and the agent's kiosk.

Work By Others:

Utilities: Utility relocations and adjustments (by others). Reference STATUS OF UTILITIES TO BE ADJUSTED for additional information.

CTA: CTA flagging and coordination. Reference CTA FLAGGING AND COORDINATION for additional information.

SOILS INFORMATION

Soil boring logs are shown in the Plans for Peoria Street.

The reports below are available for inspection at IDOT District 1, 201 W. Center Court, Schaumburg, Illinois.

Structure Geotechnical Report
Performed for Peoria Street Bridge Over Interstate 290
SN 016-1708, Section 2525.1-1B
IDOT D-91-259-13, PTB 163/ITEM 001
Cook County, Illinois
Prepared by:
Wang Engineering, Inc.
April 16, 2013

CONTRACTOR COOPERATION

The Contractor's attention is directed to the fact that other separate contracts may be under construction during the duration of this Contract. Adjacent contracts may consist of, but are not limited to projects near:

- Contract 60X27 – Halsted/Harrison St Watermain Materials Procurement (Circle Interchange)
- Contract 60F63 - FAI 90/94 (Kennedy Expressway) at Ohio Street
- Contract 60W25 – Morgan Street Bridge at I-290/Congress Parkway (Circle Interchange)
- Contract 60W26 – From Circle Interchange to Harrison Street Bridge (WB) and Halsted Street Bridge
- Contract 60W28 – Northwest Flyover Bridge at I-90/94 and I-290/Congress Parkway (Circle Interchange)
- Contract 60W36 – Tunnel Bulkheading (Circle Interchange)
- Contract 60W71 – Harrison Street Bridge (East) at I-90/94 (Circle Interchange)
- Contract 60X62 – Peoria Street Aesthetics Contract
- University of Illinois at Chicago Contract – CUPPA Hall Renovations
- And others.

The Contractor will be governed by Article 105.08 of the Standard Specifications.

The Contractor will coordinate proposed project start dates and sequence of construction with the Engineer and other Contractors to present an effective and timely schedule for successful completion of the project.

The work included within Contract 60W26 to bulkhead and fill the water tunnel below Peoria Street is required to be complete prior to the start of any foundation work for the new substructure elements of the Peoria Street Bridge. The Contractor cannot begin foundation work prior to written authorization from the Engineer that the work under Contract 60W26 has been completed and accepted by the Department.

The work included within Contract 60W25 to reconstruct the Morgan Street Bridge and reopen access to the UIC - Halsted Blue Line CTA Station Entrance is required to be complete prior to the start of any work for the Peoria Street Bridge which would require closure of the UIC – Halsted Street Blue Line CTA Station Entrance adjacent to the Peoria Street bridge. Access to the station from the north and south ends of Peoria Street must be maintained until access has been reopened at Morgan Street. The Contractor cannot begin this work prior to written authorization from the Engineer that the required work under Contract 60W25 to reopen access to the UIC - Halsted Blue Line CTA Station Entrance from the Morgan Street Bridge has been completed and accepted by the Department.

ADDITIONAL INSURED

Add the following paragraph at the end of Article 107.27 – Insurance, of the Standard Specifications for Road and Bridge Construction dated January 1, 2012:

The Contractor shall name The Board of Trustees of the University of Illinois, its elected and appointed trustees, officers and officials, employees, agents, successors, and assignees as additional insured in the Contractor's comprehensive general liability insurance and all risk property insurance policies.

The Contractor and the Engineer shall mail, by certified mail, an executed copy of the Certificate of Insurance to the University of Illinois at Chicago (UIC) prior to the start of construction on this project noted above. The address will be provided by the Engineer.

All costs related to this requirement will be paid for under Article 109.04 – Payment for Extra Work.

PROGRESS SCHEDULE

Description. Time is of the essence in this Contract. It may be necessary for the Contractor to work longer hours, use additional crews, and work during weekends in order to complete the work within the required time limit. The Contractor shall submit a Critical Path Method (CPM) Progress Schedule as described below for the Engineer's approval before the work can be started.

The Contractor will not be allowed any additional compensation for working longer hours or using extra shifts; and working on weekends or during Holidays; working during winter months, etc. to meet the specified Completion Date.

This work shall consist of preparing, revising and updating a detailed progress schedule based upon the Critical Path Method (CPM). This work shall also consist of performing time impact analysis of the progress schedule based upon the various revisions and updates as they occur.

Requirements. The software shall produce an electronic progress schedule for submission to the department that is 100% compatible with Primavera SureTrak 3.0 Project Manager, published by Primavera Systems, Inc.

Format. The electronic schedule format shall contain the following:

- a. Project Name: (Optional).
- b. Template: Construction.
- c. Type: SureTrak: Native file format for stand-alone contracts.
- d. Planning Unit: Days (calendar working).
- e. Number/Version: Original or updated number.
- f. Start Date: Not later than ten days after execution of the contract.
- g. Must Finish Date: Completion date for completion date contracts.
- h. Project Title: Contract number.
- i. Company Name: Contractor's name.

Calendars.

- a. Completion Date Contracts. The base calendar shall show the proposed working days of the week and the proposed number of work hours per day.

Schedule Development. The detailed schedule shall incorporate the entire contract time. The minimum number of activities shown on the schedule shall represent the work incorporating the pay items whose aggregate contract value constitutes 80 percent of the total contract value. These pay items shall be determined by starting with the pay item with the largest individual contract value and adding subsequent pay item contract values in descending order until 80 percent of the contract value has been attained. Any additional activities required to maintain the continuity of the schedule logic shall also be shown.

The following shall be depicted in the schedule for each activity:

- a. Activity Identification (ID) Numbers. The Contract shall utilize numerical designations to identify each activity. Numbering of activities shall be in increments of not less than ten digits.
- b. A description of the work represented by the activity (maximum forty-five characters). The use of descriptions referring to a percentage of a multi-element item (i.e., construct deck 50%) shall not be used. Separate activities shall be included to represent different elements of multi-element items (i.e., forms, reinforcing, concrete, etc.). Multiple activities with the same work description shall include a location as part of the description.
- c. Proposed activity duration shall be shown in whole days. The Contractor shall provide production rates to justify the activity duration. Schedule duration shall be contiguous and not interruptible.

The schedule shall indicate the sequence and interdependence of activities required for the prosecution of the work. The schedule logic shall not be violated.

Activities should be broken down such that each activity encompasses a single operation or tightly-integrated operations in a single, contiguous and continuous area of the project, with no activity exceeding \$200,000 without the consent of the Engineer.

Total Float shall be calculated as finish float. The schedule shall be calculated using retained logic. The Contractor shall not sequester float by calendar manipulations or extended duration. Float is not for the exclusive use or benefit of either the Department or the Contractor.

Tabular Reports.

- a. The following tabular reports will be required with each schedule submission:
 1. Classic Gantt
 2. Pert with Time Scale
- b. The heading of each tabular report shall include, but not be limited to, the project name, contract number, Contractor name, report date, data date, report title and page number.
- c. Each of the tabular reports shall also contain the following minimum information for each activity.
 1. Activity ID
 2. Activity Description

3. Original Duration (calendar day/working day)
 4. Remaining Duration (calendar day/working day)
 5. Activity Description
 6. Early Start Date
 7. Late Start Date
 8. Early Finish Date
 9. Late Finish Date
 10. Percent Complete
 11. Total Float
 12. Calendar ID
 13. Work performed by DBE Subcontractors and Trainees shall be shown in the Gantt Report.
- d. Reports shall be printed in color on 11 in. x 17 in. (minimum) size sheets. The Classic Gantt shall show all columns, bars, column headings at the top, time scale at the top and shall show relationships.

Submission Requirements. The initial schedule shall be submitted prior to starting work but no later than five calendar days after execution of the contract. Updated schedules shall be submitted according to Article 108.02 except that as a minimum, updated schedules will be required at the 25, 50, and 75 percent completion points of the contract.

Updating.

- a. The Contractor shall not make any changes to the original duration, activity relationships, constraints, costs, add or delete activities, or alter the schedule's logic when updating the schedule.
- b. The originally approved baseline CPM schedule will be designated as the "Target Schedule" and shall only be changed based on a Change Order that extends the Contract duration. All updates will be plotted against the "Target Schedule." If the Contractor believes any such changes result in an overall increase in the contract time, the Contractor will immediately submit a request for extension of time along with the changed progress schedule and a detailed justification for the time extension request in accordance with Article 108.08.

- c. The updated information will include the original schedule detail and the following additional information:
 - 1. Actual start dates
 - 2. Actual finish dates
 - 3. Activity percent completion
 - 4. Remaining duration of activities in progress
 - 5. Identified or highlighted critical activities
- d. The Contractor shall submit scheduling documents in the same formats and number as indicated in this section.
- e. The Engineer shall withhold progress payments if the Contractor does not submit scheduled updates as required.
- f. Upon receipt of the CPM schedule update, the Engineer will review the schedule for conformance with the Contract Documents and degree of detail. The Engineer, within fourteen (14) Days after receipt of the Updated CPM Schedule and supporting documents, will approve or reject it with written comments. If the Updated CPM schedule is rejected, the Contractor must submit a Revised Updated CPM Schedule within seven (7) Days after the date of rejection.
- g. The updated progress schedule must accurately represent the Project's current status.

Contractor Changes to the Schedule.

The Contractor shall comply with the following requirements regarding proposed changes to the approved baseline CPM schedule:

- a. If the Contractor proposes to make any changes in the approved baseline CPM schedule, the Contractor shall notify the Engineer in writing, stating the reasons for the change, identifying each changed activity (including duration and interrelationships between activities) and providing a diskette of the proposed changed schedule. Every effort must be made by the Contractor to retain the original Activity ID numbers.
- b. The Engineer has the authority to approve or disapprove the proposed change in the baseline CPM schedule and shall do so in writing within ten (10) Days after receipt to the Contractor's submission.
- c. If the Engineer approves the change in the baseline. All monthly updates will be plotted against the new "Target Schedule".

- d. If the Engineer approves a portion of the change to the baseline CPM schedule, the Contractor shall submit a revised CPM schedule incorporating such change(s) within ten (10) Days after approval along with a written description of the change(s) to the schedule.

Recovery Schedule.

- a. The Contractor shall maintain an adequate work force and the necessary materials, supplies and equipment to meet the current approved baseline CPM schedule. In the event that the Contractor, in the judgment of the Engineer, is failing to meet the approved CPM schedule including any Contract milestones, the Contractor shall submit a recovery schedule.
- b. The recovery schedule shall set forth a plan to eliminate the schedule slippage (negative float). The plan must be specific to show the methods to achieve the recovery of time, i.e. increasing manpower, working overtime, weekend work, employing multiple shifts. All costs associated with implementing the recovery schedule shall be borne by the Contractor.
- c. Upon receipt of the CPM recovery schedule, the Engineer will review the schedule for conformance with the Contract Documents and degree of detail. The Engineer will approve the schedule or reject it with written comments within fourteen (14) Days of receipt of the recovery schedule and supporting documents. If the detailed CPM recovery schedule is rejected, the Contractor must submit a revised CPM recovery schedule within seven (7) Days of the date of rejection.

Revised Schedule.

The Engineer may direct the Contractor to revise the approved CPM schedule. Reasons for such direction may include, but are limited to, the following: (1) changes in the Work, (2) rephrasing of the Project or any phase, (3) a change in the duration of the Project or phase, and (4) acceleration of the Project or phase.

- a. The Engineer will direct the Contractor to provide a revised CPM schedule in writing.
- b. The Contractor will provide the revised CPM schedule within ten (10) Days of receipt of the Engineer's written direction.
- c. The Engineer has the authority, in its sole discretion, to approve or reject the revised CPM schedule and will do so in writing within ten (10) Days after receipt of the Contractor's submission. If the Engineer approves the revised schedule, such schedule will be designated the new "Target Schedule".

The schedule shall be submitted in the Sorted by Activity Layout (SORT4). The activities on the schedule shall be plotted using early start, late start, early finish, late finish and total finish.

For every schedule submission, the Contractor shall submit to the Engineer, four Windows XP compatible compact disks of all schedule data. Included on the disks shall be all of the tabular and graphic reports, network diagrams and bar chart data. Two copies shall be submitted on CD/R disks and two copies shall be submitted on CDD/RW disks. In addition, four plots of the CD/R disks will be approved initial or revised progress schedule for the contract. The approval will be documented by the Engineer on a corresponding plot of the schedule and returned to the Contractor.

Four copies of each schedule submission shall be printed in color on 11 in. x 17 in. (minimum) size sheets showing all columns, bars, column headings at the top, time scale at the top and showing relationships.

The schedule shall indicate the critical path to contract completion. Only one controlling item shall be designated at any point in time on the schedule.

Acceptance or approval of any progress schedule by the Engineer shall not be construed to imply approval of any particular method of construction, sequence of construction, any implied or stated rate of production. Acceptance will not act as a waiver of the obligation of the Contractor to complete the work in accordance with the contract proposal, plans and specifications, modify any rights or obligations of the Department as set forth in the contract, nor imply any obligation of a third party. Acceptance shall not be construed to modify or amend the contract or the time limit(s) therein. Acceptance shall not relieve the Contractor of the responsibility for the accuracy of any of the information included on the schedule. Failure of the Contractor to include in the schedule any element of work required for the performance of the contract, any sequence of work required by the contract, or any known or anticipated condition affecting the work shall not excuse the Contractor from completing all work required within the time limit(s) specified in the contract notwithstanding acceptance of the schedule by the Engineer.

Basis of Payment. This work will not be paid for separately, but shall be considered as included in the costs of the various items of work in the contract.

SUBMITTALS

There are elements of construction that may require long lead times between order and delivery to the project site for installation. The Contractor must prioritize timely submittals of shop drawings to minimize any delays in project execution.

Shop drawings for structural steel that is required to be galvanized must be submitted within one (1) week of the award of the contract. The submittal must be complete and include information on the steel as well as materials and processes proposed for galvanization. No additional compensation and no extension of calendar days will be made due to delays in receiving structural steel to the project area because of incomplete or delayed shop drawing submittals.

Shop drawings for structures, pipes, fittings, and other items related to the construction of the siphon along the east side of Peoria Street must be submitted within one (1) week of the award of the contract. No additional compensation and no extension of calendar days will be made due to delays in receiving the materials to the project area because of incomplete or delayed shop drawing submittals.

The Contractor shall provide notice to the Engineer concerning shop drawing submittal schedules and when shop drawing submittal deadlines may be delayed.

STAGING AND INTERCHANGE RESTRICTIONS

Prior to the actual beginning and completion of the various stages of construction and traffic protection, the Contractor will be required to provide lane closures and barricade systems, for preparation work such as pavement marking removal, temporary lane marking, placing temporary concrete barrier, relocating existing guardrail, etc. These lane closures and barricade systems, including barricades, drums, cones, lights, signs, flaggers etc. shall be provided in accordance with details in the plans and these Special Provisions and as approved by the Engineer. The cost of this work will not be paid for separately but shall be considered included in the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS).

LANE AND RAMP CLOSURES

Prior to and after stage construction, temporary closures of I-290 will only be permitted at night during the allowable hours as listed in the Special Provision "Keeping the Expressway Open to Traffic".

For all ramp closures the Contractor shall furnish and install signage per District Detail TC-08, as directed by the Engineer.

The Contractor shall coordinate the work such that no two (2) adjacent entrance or exit ramps in one direction of the expressway are closed at the same time. The closing of ramps, which are used as the detour route for other roadways or ramps, is prohibited. Should the Contractor fail to completely open, and keep open, the ramps to traffic in accordance with the above limitations, the Contractor shall be liable to the Department for liquidated damages as noted under the Special Provision, "Failure to Open Traffic Lanes to Traffic".

The Contractor shall submit to the Department two (2) weeks ahead of time, in writing, the starting date for each of the extended ramp and/or lane closures. Approval from the Department is required prior to closing the ramp and/or lanes. Should the Contractor fail to complete the work and reopen the ramp to traffic within the allowable time limit, the Contractor shall be liable to the Department for liquidated damages as noted under FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC.

TRAFFIC STAGING

The following is a brief description of the traffic staging, which will be required from the Contractor during the reconstruction of the expressway. The following description shall be correlated with the Maintenance of Traffic (MOT) details located in the plans and these Special Provisions.

This suggested sequence of operations and summary for Traffic Staging does not, nor is it intended to, depict all the work that will be required by the Contractor for the maintenance of traffic during this Contract. This summary is given as an aid and guide for the Contractor's use to establish the necessary guidelines to insure a safe and as smooth as possible traffic operation during the duration of the Contract.

Stage 1A:

- Existing utilities to be relocated by others as noted on the plans. The relocation of the existing utilities shall be coordinated with and is at the discretion of the utility agencies.
- Place the temporary shoring to support the existing CTA station on the west side of the bridge and the stairs on the east side of the bridge.
- Remove the CTA equipment in the existing brick house building on the bridge.
- Remove the existing brick house on the bridge.
- Relocate the existing electrical and communications conduits and cabling that are mounted to the underside of the platform where they interfere with the installation of the temporary platform support shoring and in areas where the platform will be removed for the proposed work.
- Relocate the ITS communications and power cable lines along EB and WB I-290 as shown on the plans.
- Remove the existing bridge mounted guide signs on Peoria Street and install the proposed bridge mounted signs on Morgan Street.
- Remove the existing Peoria Street Bridge superstructure, abutments, Pier 2 and approaches.
- Remove the existing concrete barrier wall along both shoulders of WB I-290 and the outside shoulder of EB I-290.
- Remove the curb and gutter along the outside shoulder of WB I-290.
- Construct all of the substructures except for Pier 1.
- Demolition and reconstruction of Peoria Street Bridge (SN 016-1708) piers and superstructure adjacent to the CTA shall be coordinated with the CTA. CTA track access is allowed during off-peak hours only. All CTA track access shall be coordinated and performed in accordance to the discretion of the CTA. Refer to the "CTA flagging and coordination" special provision for requirements when working adjacent to or above the CTA right-of-way.

- Construct the temporary pavement (to remain) and concrete barrier wall along the outside shoulder of EB I-290 and inside shoulder of WB I-290. Construct the temporary pavement (to remain) and curb and gutter along the outside shoulder of WB I-290.
- Begin reconstruction of the siphon along Peoria Street.
- Begin construction of the north end of Peoria Street.
- Construct the stabilized construction entrance.
- Begin construction of the south end of Peoria Street.

Stage 1B:

- Continue work along Pier 2 and the north abutment, if required.
- Remove the existing CTA PA speakers, CCTV cameras, communications signage and telephone equipment in the area of the platform renovation work. Turn over the devices to the CTA.
- Provide temporary conduits and cabling for the existing electrical, lighting, CCTV, PA System and communications systems that are mounted to the underside of the platform canopy and routed through the proposed work area. Maintain the existing platform level systems throughout construction.
- Remove the existing Pier 1.
- Remove the existing concrete barrier wall along the inside shoulder of EB I-290.
- Construct Pier 1.
- Demolition and reconstruction of Peoria Street Bridge (SN 016-1708) piers and superstructure adjacent to the CTA shall be coordinated with the CTA. CTA track access is allowed during off-peak hours only. All CTA track access shall be coordinated and performed in accordance to the discretion of the CTA. Refer to the "CTA flagging and coordination" special provision for requirements when working adjacent to or above the CTA right-of-way.
- Construct the temporary pavement (to remain) and concrete barrier wall along the inside shoulder of EB I-290.
- Complete construction of the bridge superstructure, including bridge railings, bridge lighting and bridge deck latex concrete overlay.
- Remove the temporary shoring and re-attach the CTA station on the west side of the bridge and the stairs on the east side of the bridge to the new fascia beams.
- Complete reconstruction of the siphon along Peoria Street.
- Complete construction of the north end of Peoria Street.
- Construct the stabilized construction entrance.
- Continue construction of the south end of Peoria Street.

Stage 2:

- Rehabilitate the CTA station glass building.
- Remove and replace the existing CTA station platform, canopy and stairs for the new elevator and station house extension.
- Complete construction of the sidewalk on the south end of Peoria Street, including all drainage, earthwork, lighting and landscaping activities.

Stage 3:

- Remove the existing east sidewalk on the south end of Peoria Street and complete all earthwork and landscaping activities.
- Reconstruct the sections of sidewalk and curb and gutter along Harrison Street as shown on the plans.

WINTER WORK

No adjustment will be made in the contract unit prices for any concrete if winter work is necessary to meet the required completion dates specified in the contract.

CTA FLAGGING AND COORDINATION

All work to be done by the Contractor on, over, or in close proximity of the CTA (Chicago Transit Authority) right-of-way shall be performed according to Article 107.12 of the Standard Specifications and this specification. This specification generally conforms to CTA Master Specification Section 01 35 15, "Special Project Procedures for Adjacent Construction." No interruption to CTA service will be allowed unless approved in writing by the CTA.

The CTA's Representative for this project will be:

Mr. Rick Herndobler
Manager, Capital Construction
(312) 681-3921

1.01 SUMMARY

- A. This section includes the requirements for safe construction operations on, above, below and adjacent to operating tracks of the CTA rail system. The Contractor shall be responsible for compliance with the CTA Safety Manual for Contract Construction On, Above, or Adjacent to the CTA Rail System in effect at such time.

- B. After the letting of the contract and prior to performing any work, the CTA Representative shall be notified by the Department to attend the preconstruction meeting. In this meeting, the Contractor shall confer with the CTA's Representative regarding the CTA's requirements for the protection of clearances, operations and safety.
- C. Prior to the start of any work on or over the CTA's right-of-way, the Contractor shall meet with the CTA Representative to determine his requirements for flagmen and all other necessary items related to the work activities on, over and next to the CTA facilities and to receive CTA's approval for the Contractor's proposed operations.
- D. The Contractor shall notify the CTA Representative 72-hours in advance of the time he intends to enter upon the CTA right-of-way for the performance of any work.

1.02 PROJECT CONDITIONS

- A. The Chicago Transit Authority (CTA) is an operating transportation agency and must maintain rail operations at all scheduled times for the benefit of the public. The Contractor shall conduct his operations in such a manner as not to cause damage to the CTA equipment, put the public or the CTA personnel in danger, cause inconvenience to the customers, interrupt train service (except as permitted herein) or cause avoidable inconvenience to the public and the surrounding communities.
- B. The CTA will be operating trains during the construction of this project. The rail operations are 24 hours per day, seven days per week.
- C. Certain portions of the project may be performed on, above or adjacent to sections of track where rail service is suspended in order to facilitate the work. For any work occurring within, above or adjacent to a section of track to be taken out of service, the Contractor shall confirm with the CTA that track within the work limits has been taken out of service and the third rail de-energized, as required, prior to beginning the work.
- D. If the CTA deems any of the Contractor's work or operations hazardous to the CTA's operations or to the public, the CTA shall contact the Engineer. The Engineer may elect to order the Contractor to immediately suspend work until reasonable remedial measures are taken satisfactory to the CTA.

- E. The CTA may review of any of the Contractor's procedures, methods, temporary structures, tools or equipment that will be utilized within the CTA Right-of-Way. These reviews do not relieve the Contractor of responsibility for the safety, maintenance, and repairs of any temporary structure or work, or for the safety, construction, and maintenance of the work, or from any liability whatsoever on account of any procedure or method employed, or due to any failure or movement of any temporary structure, tools or equipment furnished as necessary to execute work on CTA Right-of-Way.
- F. At least five (5) weeks prior to the start of any work on, above or adjacent to the CTA right-of-way, the Contractor will be required to attend weekly coordination meetings with CTA Operations and other CTA departments to review and coordinate proposed work activities of the Contractor(s). The Contractor will be required to provide a five week look-ahead schedule, in a format acceptable to CTA, reflecting proposed work activities within the CTA Right-of-Way.
- G. The Contractor, through the Engineer, shall submit a Rail Service Bulletin Request form to the CTA at least twenty-one (21) calendar days in advance of the Contractor's proposed scheduled time to enter upon the CTA Right-of-Way for the performance of any work under this Contract. Bulletin requests will be required when performing work which impacts rail operations such as prior to each phase of staged station construction, Track Access Occurrences, track survey, etc.
- H. CTA generally permits only one Track Access Occurrence at a time on any given route. Other work on CTA's system, including required operations and/or maintenance by CTA, or work by other contractors elsewhere on the route, may limit the available dates of track access occurrences for this project. The contractor is strongly encouraged to submit Rail Service Bulletin requests with more than the twenty-one (21) day minimum required advance notice. The CTA has indicated that they typically will not grant Track Access Occurrences on consecutive weekend periods in order to provide scheduled service to customers.
- I. The Contractor shall at all times observe all rules, safety regulations and other requirements of the CTA, including, but not limited to, the following Standard Operating Procedures (SOP's).
 - 1. No. 7037, "Flagging on the Right-of-Way".
 - 2. No. 7038, "Train Operation Through Slow Zones".
 - 3. No. 7041, "Slow Zones".
 - 4. No. 8111, "Workers Ahead Warning System".
 - 5. No. 8130, "Safety on Rapid Transit Tracks".
 - 6. No. 8212, "Test Train Procedures".
 - 7. Sketch 2000-SZ-1, Slow Zone Equipment.

1.03 REIMBURSEMENT OF COSTS

- A. The cost of all flagmen, infrastructure crews, engineering inspection, switchmen, and other workmen furnished by the CTA and authorized by the Engineer shall be paid for directly to the CTA by the contractor.
- B. The costs associated with Track Access Occurrences granted and established by the CTA shall be paid for directly to the CTA by the Contractor.
- C. The amount paid to the Contractor shall be the amount charged to the Contractor for all authorized CTA charges including CTA additive rates audited and accepted by the Department, according to Article 107.12 and Article 109.05 of the Standard Specifications.
- D. Following approval of the CTA invoices by the Department, the Contractor shall pay all monies to the CTA as invoiced and shall submit to the Department certified and notarized evidence of the amount of payments. No overhead or profit will be allowed on these payments.
- E. There are maximum amounts of flagger shifts identified within this specification. If Contractor operations require flagger shifts that are granted by the CTA beyond these limits, the Contractor shall pay for the services, but will receive no reimbursement.
- F. The Department will not be liable for any delays by the CTA in providing flagmen, establishing track closures or other service provided by the CTA and identified within this special provision.

1.04 RAIL SAFETY TRAINING

- A. All Contractor and Subcontractor employees assigned to work on, over or near the CTA Right-of-Way shall be required to attend an all-day Rail Right-of-Way Safety Training Session in accordance with the CTA Safety Manual for Contract Construction On, Above, or Adjacent to the CTA Rail System. The cost of this training is currently \$200.00 per employee, paid by the Contractor in advance. The certification is good for one calendar year from the date of issuance. The Contractor shall coordinate rail safety training with the Engineer. The cost of training shall be paid directly to the CTA by the Contractor.
- B. Rail Right-of-Way Safety Training for contractor and subcontractor personnel will be scheduled by CTA as training slots become available. The Contractor is advised that the Contractor's failure to request training sufficiently in advance of when the employee is required on the work site shall not be cause for relaxing the requirement for Rail Right-of-Way Safety Training.

- C. The \$200.00 fee is non-refundable. If any individual fails to report for training or is rejected for training and must be rescheduled, an additional \$200.00 will be required. No additional compensation will be made for the rescheduling of any training.
- D. Upon successful completion of CTA Rail Safety Training, each trainee will be issued a non-transferable Rail Safety Tour Identification Card with the trainee's photo and a decal with pressure sensitive adhesive to be affixed on the hard hat. The Rail Safety Tour Identification Card and the decal are valid for one (1) year from the date of issue. The validity of the Card and the decal are in no way related to the length of this Contract.
- E. Contractor and Subcontractor personnel must renew their Rail Safety Tour Identification Cards annually by successfully completing Rail Safety Training again. Contractor or Subcontractor personnel who fail to maintain a valid Rail Safety Tour Identification Card are not permitted to work on, above or adjacent to the CTA Rail Right of Way and CTA reserves the right to remove such personnel from the work site.
- F. The costs incurred by the Contractor for CTA Rail Safety Training will not be reimbursed.

1.05 MANDATORY ITEMS FOR EMPLOYEES ON CTA RIGHT-OF-WAY

- A. Contractor's and Subcontractor's employees assigned to work on the CTA Right-of-Way:
 - 1. Contractor's and Subcontractor's employees will be given individual property permits. These permits shall be carried by each employee at all times while on CTA property. All permits issued shall be returned to CTA at the completion of the project, if the employee no longer works on this project, or on the date of expiration.
 - 2. Each employee shall carry a valid Rail Safety Tour Identification Card at all times while on CTA right-of-way in accordance with Article 2-2 of the CTA Safety Manual.
 - 3. All employees shall wear an undamaged hard hat with current rail safety sticker affixed, CTA standard safety vest and eye protection at all times while on CTA right-of-way. Noise protection shall be used when necessary. The Contractor must also comply with all OSHA requirements as required for the work. The CTA shall provide the rail safety sticker to each Contractor employee upon successful completion of the Rail Right-of-Way Safety Training.

4. Contractor personnel shall wear suitable work shoes with defined heel and non-slip soles. Steel toes or metal cleats on the sole or heel of shoes are prohibited. Shoelaces are to be kept short so they do not pose a tripping hazard. Athletic shoes, sandals, open-toed shoes, moccasins and/or shoes with heels higher than 1" are not permitted.
 5. Contractor personnel shall have a non-metallic, working flashlight after dark or when working in the subway.
- B. Contractor and Subcontractor employees assigned to work adjacent to or above the CTA right-of-way shall wear a CTA standard safety vest at all times. Personnel without current Rail Safety Training and a valid property permit shall not enter onto any CTA Right-of-Way.

1.06 WORK AREA AVAILABILITY

A. DEFINITIONS

1. RIGHT-OF-WAY WORK: Any work performed at, above, or below track level within the CTA Right-of-Way.
2. IN-SERVICE TRACK: All CTA tracks are in service seven days a week, 24 hours a day, unless specifically removed from service for specific times by a Rail Service Bulletin issued by the Vice President, Rail Operations. Copies of the CTA's current train schedule for the lines affected by this project is available on the CTA's website and are subject to changes at any time, before or during, the Contract.
3. OUT-OF-SERVICE TRACK: The CTA tracks within limits defined by CTA that are temporarily removed from service for the purpose of completing specific work. Traction power will remain on at all times unless power removal is requested by the Contractor and approved by the CTA. In such cases, traction power must be removed and restored by CTA personnel. The Contractor may request the CTA to de-energize portions of the CTA right-of-way to perform work on, or near an Out-of-Service Track when no revenue service is scheduled, or as specified under a Rail Service Bulletin. Upon completion of the Out-of-Service Work, the Contractor shall maintain sufficient personnel on-site to correct any deficiencies in the Contractor's Work discovered by the CTA during power and service restoration and testing.
4. TRACK ACCESS OCCURRENCE: A condition(s) which provides a modification to the normal operation of CTA service to facilitate access for a Contractor(s) to perform work on or near the CTA Right-of-Way as defined and limited herein.

5. RE-ROUTE: Modification to the normal routing of trains in order to remove rail traffic from a section of track to facilitate access for a Contractor(s) to perform work on or near the CTA Right-of-Way as defined and limited herein.
6. LINE CUT: A temporary cessation of all service on a transit line; meaning total stoppage of transit service on all tracks and at all stations within the closure zone to facilitate access for a contractor(s) to perform work on or near the CTA Right-of-Way as defined and limited herein.
7. SINGLE-TRACK: A temporary operation established by operating trains bi-directionally on one track while the adjacent track is taken out-of-service as defined in paragraph 1.06.A.4, above. Only one single-track at a time can be set up on a line and only for very limited time periods. If CTA or a separate contractor(s) request single track operations along the same line concurrently with the contractor for this contract, CTA shall have the exclusive authority to determine which request shall be granted.
8. RUSH HOURS: Monday through Friday, from 0500 to 0900 hours and from 1500 to 1900 hours.
9. FLAGGER SHIFT: A flagger shift is defined as the services of a CTA Flagman up to, but no more than eight (8) hours including travel and required breaks. For example:
 - a. A Contractor five hour work shift which requires 3 flaggers will use 3 flagger shifts.
 - b. A Contractor eight hour work shift requiring 3 flaggers shall use 6 flagger shifts (because travel & break time will increase the flaggers work hours beyond eight).
 - c. A Contractor ten hour work shift requiring 3 flaggers will use 6 flagger shifts.
10. INFRASTRUCTURE SHIFT: An infrastructure shift is defined as up to, but no more than eight (8) hours worked per CTA Infrastructure employee. For example:
 - a. A Contractor five hour work shift requiring 2 signal maintainers will use 2 infrastructure shifts.
 - b. A Contractor eight hour work shift requiring 2 towermen shall use 2 infrastructure shifts.
 - c. A ten hour work shift requiring 2 lineman will use 4 infrastructure shifts.

11. PERSON-IN-CHARGE (PIC): A person or persons, specified in a CTA Rail Service Bulletin, who is solely in charge of a work zone and is the single point contact between CTA and all persons (Contractor's, CTA and others) working in a work zone. The Rail Service Bulletin may identify the PIC by name or by radio call number. The Engineer or the Engineer's designee shall serve as PIC.
 12. POWER & WAY SERVICE BULLETIN (PWS Bulletin): A document authorized by the CTA Infrastructure Division intended to supplement a CTA Rail Service Bulletin by defining power/signal removal and restoration procedures and other work zone protection measures required to safely perform construction and/or maintenance work on or adjacent to the CTA Right-of-Way (ROW).
- B. No service disruptions will be allowed for the completion of this work, except as noted herein. If the CTA deems it necessary, the CTA will impact operations to avoid a hazardous condition to either the passengers or employees and charge the Contractor for all associated costs and damages incurred. No compensation will be made for CTA charges to the Contractor due to unauthorized Contractor access or other unapproved impacts to CTA operations.

1.07 CTA OPERATING REQUIREMENTS

1. Strictly comply with operating requirements of the Chicago Transit Authority while construction work is in progress, specifically as follows:
 1. All work performed on the CTA Right-of-Way will be allowed during the Construction Period only in accordance with the Article 1.08 "ALLOWABLE HOURS OF CONSTRUCTION". During most periods of construction, a "slow zone" shall be established at the work site and flagging personnel shall be deployed to facilitate safe and continuous train operations and to protect Contractor, CTA employees, passengers, the general public and property in the vicinity.
 2. No one is permitted to enter the CTA Right-of-Way during Rush Hours. Access to the underside of the existing or proposed bridge structure within the limits of the CTA Right-of-Way will not be permitted.
2. As much work as possible is to be done under normal CTA operating conditions (under traffic) without disruption of train movements. A maximum interruption of service to the CTA traffic of 15 minutes or as agreed upon with the CTA will be allowed. No interruption to CTA service will be allowed unless approved in writing by the CTA. The CTA has indicated during overnight periods, train headways are between fifteen (15) and thirty (30) minutes.

3. Pedestrian traffic to the CTA facility entrance at Peoria Street shall be prohibited until the bridge is reopened to pedestrian traffic as shown in the plans. Barricades and signage for closures of the entrance at Peoria Street must be coordinated with the CTA at least twenty-eight (28) days prior to modifications to staging.
4. Access control of the CTA Right-of-Way must be maintained at all times. This includes eliminating openings directly to the Right-of-Way where existing median barriers are to be removed. All planned removals of existing access control must be coordinated with the CTA, with plans for counter measures provided to the CTA at least three (3) weeks prior to removals.

1.08 ALLOWABLE HOURS OF CONSTRUCTION

- A. Construction activities within CTA Right-of-Way are not permitted during Rush Hours. Access to the underside of the existing or proposed bridge structure within the limits of the CTA Right-of-Way will not be permitted during Rush Hours.
- B. Construction activities within CTA Right-of-Way may be permitted during non-Rush Hour periods under flagging protection with the advance concurrence of the CTA as follows:
 1. Monday thru Friday: From 1900 hours to 0500 hours the next day (the power shall remain on for these hours unless allowed via specific Track Access Occurrence).
 2. Weekends: 1900 hours Friday to 0500 hours Monday
- C. Track Access Occurrences:
 1. The total number of Track Access Occurrences shall be as specified below:
 - a. Weekday Overnight Single Tracks: A maximum of thirty (30) Weekday Overnight Single-Track Track Access Occurrences will be permitted. Construction activities within the CTA Right-of-Way may be permitted on Monday through Thursday nights between the hours of 22:00 and 04:00 the following morning, including any time required for test trains stipulated in the Rail Service Bulletin. Fifteen (15) Weekday Overnight Occurrences will be permitted for the bridge reconstruction during Stage 1A/1B. Fifteen (15) Weekday Overnight Occurrences will be permitted for the station rehabilitation during Stage 2 and 3.

- b. Extended Weekend Overnight Single Tracks: One (1) Extended Weekend Overnight Single-Track Track Access Occurrence will be permitted. This Track Access Occurrence shall be used to install the temporary shoring for the CTA Station prior to removal of the existing Peoria Street Bridge. Construction activities within the CTA Right-of-Way may be permitted between the hours of 22:00 Friday night and 8:00 the following morning, including any time required for test trains stipulated in the Rail Service Bulletin.
 - c. Weekend Single Tracks: A maximum of eight (8) Weekend Single-Track Track Access Occurrences will be permitted. Construction activities within the CTA Right-of-Way may be permitted between the hours of 22:00 Friday night and 04:00 the following Monday morning, including any time required for test trains stipulated in the Rail Service Bulletin. Four (4) Weekend Occurrences will be permitted for the bridge reconstruction during Stage 1A/1B. Four (4) Weekend Occurrences will be permitted for the station rehabilitation during Stage 2 and 3.
2. The exact dates and hours for all Track Access Occurrences are subject to change by the CTA depending on the nature of the work, access requirements of CTA personnel, work performed under separate contract or operational requirements of the CTA. The approval of specific dates and times for Track Access Occurrences on this Contract may be affected by major events or by a Track Access Occurrence scheduled elsewhere on that route or the CTA System. Consecutive weekend periods may not be possible due to special events and other track access needs on the CTA rail system.
 3. The Department has identified the following windows to the CTA for completing proposed work adjacent to the tracks. The majority of requested Track Access Occurrences should be for weekend and weeknight periods during the following windows:
 - a. Stage 1A/1B – July 7, 2014 through November 3, 2014 (All Track Access Occurrences prior to August 4, 2014 must be overlapping occurrences with Contract 60W26 or 60W25.
 - b. Stage 2 & 3 – November 4, 2014 through March 30, 2015

The CTA may grant access outside of the above window(s) depending on Contractor progress and Contractor needs.

4. Contractors completing other Department projects may also request Track Access Occurrences along the same section of track as described herein. These projects are identified in CONTRACTOR COOPERATION. Provided these Track Access Occurrences are approved, scheduled and initiated by the CTA, the Contractor shall be able to access CTA Right-of-Way with no impact to the total count of Track Access Occurrences attributed to this Contract.

- D. The CTA reserves the right to modify the allowable dates or hours of track access occurrences based on service requirements for the subject route and manpower availability for the date and location requested.

- E. The CTA reserves the right to deny or to cancel a previously approved request for a Track Access Occurrence based on service requirements for the time period requested. The CTA may notify the Contractor of such denial or cancellation no later than 1 day prior to a Track Access Occurrence. Service requirements may be affected by major events (e.g., festivals, White Sox and Cubs games, concerts), or by a Track Access Occurrence scheduled elsewhere on that route or the CTA System.

- F. The Contractor will not be permitted to perform work requiring a Track Access Occurrence or Flagging during the following special events:
 1. Taste of Chicago
 2. Independence Day
 3. Chicago Air and Water Show
 4. Chicago Marathon
 5. Chicago Jazz Festival
 6. Chicago Blues Festival
 7. Chicago St. Patrick's Day Parade
 8. The Saturday before Thanksgiving Day through the Monday following Thanksgiving
 9. New Year's Eve and New Year's Day
 10. Easter Sunday
 11. Gospel Fest
 12. Chicago White Sox Home Games
 13. Chicago Cubs Home Games
 14. Chicago Bears Home Games
 15. Lollapalooza
 16. Pride Parade

In addition, CTA reserves the right to limit or deny access to the system during other major special events that may develop and that may impact service needs, during emergencies, and during severe weather conditions.

The CTA, at their discretion, may provide a Track Access Occurrence or Flagging during a time period identified above provided the request is made in conformance with this specification and is properly scheduled with the CTA as required.

1.09 CONSTRUCTION PROCESS PLAN

- A. CTA will require the Contractor to submit a Construction Process Plan whenever any work, in the opinion of the CTA, affects the safety or causes disruption of service or inconvenience to transit users, CTA Operations or impacts CTA Right-of-Way including, but not limited to: protection of CTA tracks/ CTA Right-of-Way, demolition, temporary shoring installation, drilled shaft installation, pier construction, structural steel erection over CTA tracks/ CTA Right-of-Way, and any other necessary temporary construction related to the above listed items. At a minimum, an individual Construction Process Plan shall be required for each instance the Contractor requests a Track Access Occurrence from CTA and for any work that requires flagging protection from CTA. The Contractor shall also refer to the following special provisions for submittal requirements to the CTA: Temporary Soil Retention System.

- B. A draft Construction Process Plan must be submitted to CTA by such method as the CTA may direct, at least twenty-one (21) calendar days in advance of work and at least fourteen (14) calendar days prior to a pre-activity meeting. The plan shall include/address the following:
 - 1. Applicable Contract Documents
 - 2. Options
 - 3. Possible conflicts
 - 4. Compatibility problems
 - 5. Time schedules
 - 6. Weather limitations
 - 7. Temporary facilities & signage
 - 8. Space and access limitations
 - 9. Governing regulations
 - 10. Safe Work Plans (including Hazard Analysis)
 - 11. CTA Operations Impact
 - 12. Proposed Traffic Control & Staging Areas
 - 13. Lift Plan

- C. The draft plan must also include reference to all Contractor Requests for Information (RFI's) and submittals that pertain to work identified in the plan.

- D. In addition, for any work to be performed during a Track Access Occurrence, the Contractor shall provide the following to the CTA:
1. A track access plan submitted to and approved by the CTA specifically identifying the area(s) of power removal and work zone protection methods being requested by the Contractor.
 2. Work zone protection methods to be performed by the Contractor
 3. Name, title, contact information, and work hours for Contractor's on-site supervision
 4. Work zone protection requested by the Contractor for implementation by the CTA (subject to CTA approval).
 5. Pre-approved Safety and Quality Control Checklists, applicable to the work elements being performed during the specific track(s) outage request for completion by the Contractor and submission to the Person-In-Charge during Track Access Occurrence.
 6. A general schedule reflecting proposed work to be performed within the requested Track Access Occurrence.
- E. After pre-activity meeting minutes have been agreed to, all comments from the meeting must be incorporated into a final Construction Process Plan. This plan must be submitted and approved by the Engineer and CTA prior to the start of related work.
- F. Prior to the CTA implementing an authorized Track Access Occurrence, the Contractor must provide, at least 48 hours in advance, an hourly schedule broken into tasks with a defined critical path that clearly establishes milestones that may be monitored. The hourly schedule shall also include, but not be limited to:
1. Name, title, contact information, and work hours for Contractor's on-site supervision.
 2. Power removal (min 1 hour)
 3. Proposed work activities.
 4. Activities for inspection and completion of safety & quality checklists by Contractor.
 5. Submission of safety & quality checklists to the CTA's Person-In-Charge (PIC) during Track Access Occurrence. The checklists shall be submitted to the PIC prior to commencing power restoration activities.
 6. Power, Signal Restoration (min 1 hour).
 7. Test train (min ½ hour).

- G. The CTA intends to issue Power & Way Service Bulletins to supplement CTA Rail Service Bulletins. The Power & Way Service Bulletins are intended to provide procedural guidelines for safely removing and restoring the CTA's power & way systems (primarily traction power & signal) within the limits defined by the contract and Contractors specific track outage plan(s).
- H. CTA labor shall be required to de-energize and re-energize traction power and perform such other work as may be deemed by the CTA to be required pursuant to the Contractor's work activities and authorized Track Access Occurrences, etc. CTA Signal Maintainer shall also be required to observe and witness the Contractor disconnection and reconnection of temporary signal work at each location where modifications are performed to support construction activities. One Signal Maintainer will be required to witness testing at each location or housing where it is taking place. CTA Signal Maintainer shall also be required to witness the Contractor restoration safety testing, prior to the line being returned to the CTA.
- I. Two Linemen will be required at each location where traction power is energized or de-energized. The Contractor's schedule must include travel time for the CTA Electrician's (min ½ hour) if they are to energize or de-energize traction power at more than one location.
- J. Failure of the Contractor to provide the CTA the minimum specified time required for the removal and restoration of all Power & Way systems within an authorized Track Access Occurrence will result in specified liquidated damages for failure to return track(s) to service in accordance with the contract requirements. There will be no reimbursement for liquidated damages charged to the Contractor by CTA. The following schedule for liquidated damages has been established by the CTA.

From 1 minute through 29 minutes delay - \$5,000.00

From 30 minutes through 59 minutes delay – an additional \$5,000.00

For each additional hour or fraction thereof - \$30,000.00 per hour

1.10 HAZARDOUS WORKING CONDITIONS

- A. The Contractor shall caution all employees of the presence of electric third rail (600 volts DC), live cables and moving trains on CTA tracks. The Contractor shall take all necessary precautions to prevent damage to life or property through contact with the electrical or operations systems. The Contractor shall caution all employees that any contact with live electric third rail or "live" portions of train undercarriage may result in a severe burn or death.

- B. The Contractor shall establish third-rail safety precautions in accordance with CTA regulations, such as using insulating hoods or covers for live third rail or cables adjacent to the work. On every day and at every work site where a live third rail hazard exists, the Contractor shall instruct all employees of the emergency procedures. Knowledge of the disconnect switch locations or manner of disconnection shall be available at all times to the personnel on the job. Unless otherwise noted, only CTA Electricians are allowed to disconnect power.
- C. The third rail may be de-energized during authorized Track Access Occurrences. The planning and implementation of the de-energizing shall be listed in the Contractor's process plan and include documenting checklist requirements.

1.11 TRACK SAFETY

- A. The Contractor shall, at all times, take special care to conduct operations over, on, under, adjacent to, or adjoining, the CTA Right-of-Way in such a manner as not to cause damage, settlement or displacement of any structures, tracks or any portion thereof. The Contractor shall suspend such work until reasonable remedial measures, satisfactory to the Engineer and CTA, have been taken.
- B. Any damages to the CTA tracks, supporting structures or other existing facilities and properties caused by the Contractor's operations shall be replaced or repaired by the Contractor to the satisfaction of the CTA without reimbursement. Contractor shall obtain photo documentation of damaged property to the CTA prior to performing any repair or replacement work.
- C. The CTA shall have the right to perform any work it deems to be of an emergency nature and/or necessary to permit normal train operations during construction operations by the Contractor. The work to be completed by the CTA may impact the ongoing Contractor operations. If the emergency work is required due to Contractor actions, the cost of such service or emergency work provided by the CTA shall be borne by the Contractor with no reimbursement by the Department.
- D. All work shall comply with the CTA Safety Manual for Contract Construction On, Above, or Adjacent to the CTA Rail System and CTA Standard Operating Procedures.

- E. The Contractor shall take such precautions as are necessary to ensure the safety and continuity of the CTA operations and passengers. The Contractor shall provide a minimum horizontal clearance of 7'-2" from the centerline of the nearest tangent track to any falsework, bracing and forms or other temporary obstruction during the work under this Contract. The clearance requirements for curved track sections must be calculated by the Contractor to ensure encroachment into the clearance envelope will not occur. Prepare, submit and obtain approval of detailed drawings prepared and sealed by a licensed structural engineer in the state of Illinois for all falsework, sheeting and construction procedures adjacent to and under the tracks before doing any work on same. After obtaining approval of such plans, said falsework, sheeting and construction procedures shall be constructed strictly in accordance with the approved drawings and specifications. All submittals must be submitted to the Engineer to be provided to the CTA. In case of any settlement or displacement of structures or tracks, the Contractor shall immediately proceed with all shoring or other work necessary to maintain the CTA property in a safe condition for the operation of train service. If the Contractor fails to undertake this work within 24 hours after notice by the Engineer in writing, the CTA may proceed to repair or shore any such structure or tracks; and the cost thereof shall be billed to the Contractor with no compensation. If the settlement or displacement is severe enough to limit train service, the repairs shall be made immediately. All costs of any disruption to the CTA service due to the Contractor's operations or negligence shall be at the Contractor's expense with no compensation.
- F. In limited cases and with advance authorization by the CTA, a minimum horizontal clearance of 6'-1" between the centerline of the nearest tangent track and an obstruction may be allowed. This clearance does not allow CTA or Contractor personnel to safely stand between the obstruction and an operating train. In addition, an obstruction at this clearance is a hazard to motormen with a cab window open. Any required flagging by the CTA will need to be requested as described herein.
- G. A minimum vertical clearance of 14'-6" (4.42 m) above the high running rail the CTA tracks must be provided at all times.
- H. Protective Shield
1. The Contractor shall furnish, install, and later remove a protective shield to protect the CTA traffic from damage due to falling material and objects during construction.
 2. Protective shield will be necessary for any demolition activities during the removal of the existing structure as well as superstructure construction of the proposed structure.
 3. The protective shield may be a platform, a net, or any other Department approved structure.

4. Any protective shield required, as indicated on the plans and the supporting members shall be designed to sustain a load of 200 pounds per square foot in addition to its own weight.
5. Drawings and design calculations for the protective shield shall be stamped by an Illinois Licensed Structural Engineer and shall be submitted to the Department for approval. The protective shield shall be constructed only after the Department has approved the drawings and the design.

1.12 TRACK FLAGGING OPERATIONS

- A. Temporary Track Flagging slow zones per CTA SOP 7041 and "CTA Safety Manual for Contract Construction on or Near the CTA Rail System" are restricted in the following manner:
 1. Temporary track flagging slow zones can only be mobilized, utilized and demobilized in non-rush hour time periods and no more than one (1) Track Flagging Operation zone will be permitted at any given time. The CTA will be the responsible party responsible to furnish and install the required slow zone signage and equipment. A Track Flagging Operation zone is defined as a contiguous work zone, of no more than 600 feet in length, regardless of the number of tracks fouled. The costs for all manpower, signage and equipment for flagging operations will be billed by the CTA to the Contractor with reimbursement as defined herein.
 2. Current Standard Operating Procedures require Slow Zone with flagging protection whenever three or more workers are scheduled to work on, across or near a section of track for one half hour or more. Flagging protection shall be ordered and assigned according to the CTA Flagmen Requirements Manual. These standards must be adhered to and the number of flagmen assigned to a work location shall be as required by the CTA Flagmen Requirements Manual that is available for public viewing at CTA Headquarters upon request.
 3. Temporary Track Flagging slow zone signs will be placed, removed or turned by the CTA so the sign cannot be read from the motor cab or hooded to cover the sign so it may not be read from the motor cab when the work crew clears the Right-of-Way.
 4. The Contractor shall provide the Engineer with a written request for flagmen and other personnel at least seventy two (72) hours (two normal working days and before noon) prior to the date, and time the work will be performed and the CTA personnel are requested. The Engineer or the Engineer's designee will coordinate all flagmen requests with the CTA.

5. A maximum of Sixty (60) flagger shifts will be reimbursed as part of the Contract. The costs for additional flagger shifts required for the Contractor's operations that are requested and granted by the CTA will not be reimbursed.
- B. The providing of such personnel and any other safety precautions taken by the CTA shall not relieve the Contractor of any liability for death, injury or damage arising in connection with the construction operations. See CTA SOP No. 7037, "Flagging on the right-of-way", for a description of flagging personnel duties.
- C. To minimize flagmen usage, the Contractor shall use approved barricades, barricaded scaffolds and/or safety railings. Barricades and safety railing arrangements shall be in accordance with Section 4-5.3 of the CTA Safety Manual for Contract Construction On, Above, or Adjacent to the CTA Rail System.
- D. The CTA does not guarantee that flagging or other personnel will always be available when requested. The Contractor shall be advised that requests for flagging manpower must conform to the CTA Flagman Requirements Manual, and certain work locations require multiple flagging personnel when only one track is fouled by the work.
- E. The Contractor shall pay for all flagging and other personnel costs incurred and charged by the CTA. The cost for the each flagger shift shall be \$900.00 per flagger shift. The Contractor shall also be responsible to reimburse the CTA for all costs associated with the use of other personnel for infrastructure shifts throughout the duration of the contract. The cost for any other CTA personnel (signalmen, linemen, towermen, etc.) shall be \$1,100.00 per infrastructure shift.
- F. By labor contract, CTA flagging personnel are entitled to a 30-minute break after a continuous 5-1/2 hour work period, including report and travel time. The 5-1/2 hour period begins when the person reports to work at his or her home terminal. Additionally, flagging personnel are entitled to occasional personal breaks (to use the washroom facilities) during the normal course of work. When flagging personnel leave the work site, work must cease unless provision is made for a relief flagger. The Contractor shall coordinate the Project work schedule with the flagging personnel break periods.
- G. All employees of the Contractor and subcontractors shall report any actions of perceived CTA employee misconduct, or if any CTA employee does not provide a full level of cooperation in support of the contract; immediately and directly to the Engineer. The Engineer will provide written correspondence to the CTA Project Manager, as well as CTA Operations. Only with timely, written documentation will CTA be enabled to resolve work site personnel issues and take appropriate disciplinary action, when necessary.

- H. If the Contractor, Engineer, CTA Construction or Safety Inspector believes that the Flagman is unable to perform his/her duties responsibly, work shall be stopped immediately, ensure that the Right-of-Way is safe for train operations, and the Work Crew shall exit, without delay, the Rail System Right-of-Way. The Contractor must contribute incident information to the Engineer to that a written report can be submitted to the CTA prior to the end of the workday.
 - 1. In addition, all employees of the Contractor and subcontractors must report any actions of perceived CTA employee misconduct, or if any CTA employee does not provide a full level of cooperation in support of the contract immediately to the Engineer. The Engineer will then contact the CTA's Control Center and/or CTA Rail Operations Route Manager. Within 24 hours of alleged incident, the Engineer must provide a written report to the CTA including detailed explanation of incident, employee badge numbers, location of incident, etc. The Contractor must contribute incident information to the Engineer.
 - 2. Failure to make the proper notification in writing may adversely affect any claim that the Department may file with respect to CTA employee performance or lack thereof.
- I. CTA Flaggers only provide flagging protection for the CTA Right-of-Way, and only CTA Flaggers are permitted to provide flagging protection for the CTA Right-of-Way. Flaggers for streets, highways or other railroads are solely the responsibility of the Contractor, and will not be permitted to provide flagging protection for the CTA Right-of-Way. Any additional flagging required by other agencies or railroads is the responsibility of the Contractor.

1.13 TRACK ACCESS OCCURRENCES

- A. The entire system must be fully operational when the tracks are put back into service after a Track Access Occurrence. The track where work was conducted must be returned to the CTA in revenue condition; all stations must be open, fully functional and properly cleaned. The Contractor shall be immediately available with sufficient staff for up to one hour after revenue operation begins to ensure that all systems are functioning properly.
- B. The Contractor shall allow enough time prior to putting the tracks back into service to make sure the line can be fully operational. A test train shall be required after any construction activity, determined by the Engineer or CTA, to require a test train. The scheduling of test trains must include travel time to and from the location being tested. Additional time should also be allowed for any possible remedial work required before the system can be made fully operational.

- C. All components of the system, including, but not limited to, tracks, signals, stations, entrances, etc. must be fully and properly operational prior to putting the tracks and facilities back into service. Any facilities under demolition or construction and any temporary facilities must be safe and secure so they do not impact revenue service operations.
- D. The Contractor shall be subject to fines if any station, facility, yard, structure, track, or component is not fully operational and useable at the prescribed predetermined time; including all planned staging of construction sites. The CTA will identify appropriate fines at the time of the incident. No compensation will be made for fines levied by the CTA due to Contractor actions or delays in providing CTA facilities at prescribed times.
- E. The contractor shall clean all debris and equipment from the work or staging areas after work has been completed after each work day. In the event the Contractor fails to so clean to the CTA's satisfaction, the CTA may perform any necessary cleaning and fine the Contractor the cost of such cleaning. No compensation will be made for fines levied by the CTA due to delays and cleaning costs.

MAINTENANCE OF ROADWAYS

Effective: September 30, 1985

Revised: November 1, 1996

Beginning on the date that work begins on this project, the Contractor shall assume responsibility for normal maintenance of all existing roadways within the limits of the improvement. This normal maintenance shall include all repair work deemed necessary by the Engineer, but shall not include snow removal operations. Traffic control and protection for maintenance of roadways will be provided by the Contractor as required by the Engineer.

If items of work have not been provided in the contract, or otherwise specified for payment, such items, including the accompanying traffic control and protection required by the Engineer, will be paid for in accordance with Article 109.04 of the Standard Specifications.

STATUS OF UTILITIES TO BE ADJUSTED

Effective: January 30, 1987

Revised: January 24, 2013

Utility companies involved in this project have provided the following estimated durations:

NAME OF UTILITY	TYPE	LOCATION	ACTION REQUIRED	ESTIMATED DURATION OF TIME FOR THE COMPLETION OF RELOCATION OR ADJUSTMENTS
ComEd 2 Lincoln Center Sixth Floor Oakbrook Terrace, IL 60181-4260 Attn: Mr. Mark Tulach State Programs Public Relocation	Electric Ductbank Manhole/ Handhole Aerial Line Power Pole	3702+15, 24' LT to 3706+91, 24' LT 3702+15, 24' LT 3706+41, 24' LT 3705+45, 38' LT to 3707+75, 42' RT 3705+45, 38' LT 3705+44, 21' LT 3706+28, 21' LT	To be Relocated To Be Adjusted To Be Adjusted To Be Relocated To Be Relocated To Be Relocated	Start Date: January 2014 Duration: During Construction.
AT&T 1000 Commerce Drive Oak Brook, IL 60523 Attn: Ms. Pam Summers AT&T Civic Project Engineering	Underground Manhole	3701+94, 24' RT to 3706+91, 17' RT 3701+94, 24' RT 3706+17, 17' RT	To Be Relocated To Be Adjusted To Be Adjusted	Start Date: January 2014 Duration: During Construction.

<p>City of Chicago</p> <p>1411 West Madison St. Chicago, IL 60607 Attn: Mr. Frank Kelly Office of Emergency Mgmt. Communications Technical Services</p> <p>1000 East Ohio Street + 51, Room 306 Chicago, IL 60611 Attn:</p> <p>Mr. Michael Sturtevant, Deputy Commissioner Dept. of Water Management</p> <p>Mr. Rolando Villalon Dept. of Water Management - Water Section</p> <p>Mr. Sid Osakada Dept. of Water Management - Sewer Section</p>	<p>Aerial Electric</p>	<p>3702+74, 20' RT to 3707+05, 20' RT</p>	<p>To Be Removed</p>	<p>Within Roadway Contract</p>
	<p>Underground Electric</p>	<p>3702+74, 20' LT to 3702+74, 20' RT</p>	<p>To Be Removed</p>	
	<p>Electric Manhole</p>	<p>3705+14, 20' LT to 3705+14, 20' RT</p>	<p>To Be Removed</p>	
	<p>Water Main</p>	<p>3701+96, 12' LT to 3702+74, 20' LT</p>	<p>To Be Relocated</p>	
	<p>Water Manhole</p>	<p>3702+37, 12' LT to 3702+74, 20' RT</p>	<p>To Be Relocated</p>	
	<p>Water Manhole</p>	<p>3702+37, 12' LT to 3706+91, 15' LT</p>	<p>To Be Relocated</p>	
	<p>Valve Vault</p>	<p>3702+37, 12' LT to 3702+37, 12' LT</p>	<p>To Be Relocated</p>	
	<p>Hydrant</p>	<p>3702+37, 12' LT to 3702+37, 12' LT</p>	<p>To Be Relocated</p>	
	<p>Water Main</p>	<p>3705+32, 15' LT to 3705+32, 15' LT</p>	<p>To Be Removed</p>	
	<p>Water Main</p>	<p>3706+30, 12' LT to 3706+30, 12' LT</p>	<p>To Be Removed</p>	
	<p>Water Manhole</p>	<p>3707+02, 30' LT to 3707+02, 30' LT</p>	<p>To Be Adjusted</p>	
	<p>Water Manhole</p>	<p>3702+27, 40' RT to 3702+43, 40' RT</p>	<p>To Be Removed</p>	
	<p>Water Manhole</p>	<p>3705+86, 8' LT To 3706+31, 9' LT</p>	<p>To Be Removed</p>	

<p>People's Energy</p> <p>130 East Randolph Dr. 20th Floor Chicago, IL 60601 Attn: Mr. Robert Mirabel Supervisory Engineer</p>	<p>Gas Line</p> <p>Gas Valve</p>	<p>3705+65, 14' RT to 3706+95, 12' RT</p> <p>3706+23, 21' RT</p> <p>3706+95, 22' RT</p> <p>3707+00, 26' LT</p>	<p>To Be Relocated</p> <p>To Be Adjusted</p> <p>To Be Adjusted</p> <p>To Be Adjusted</p>	<p>Duration: During Construction</p>
<p>University of Illinois at Chicago</p> <p>ACCC Engineering Dept. 1940 W. Taylor St. Chicago, IL 60612 Attn: Mr. Brian Ng (312) 413-8254</p>	<p>Fiber optic lines</p> <p>Manhole</p>	<p>3701+94, 24' RT To 3705+82, 33' LT</p> <p>3700+72, 140' LT</p> <p>3700+76, 128' LT</p>	<p>To Be Relocated</p> <p>To Be Adjusted</p> <p>To Be Adjusted</p>	<p>Duration: During Construction. To be coordinated with AT&T</p> <p>To be completed during the contract</p>
<p>Chicago Transit Authority (CTA)</p> <p>567 W. Lake Street Chicago, IL 60661 Attn: Mr. Rick Herndobler Manager, Capital Construction (312) 681-3921</p>	<p>Traction Power Supply Rail</p> <p>Train Signal System</p>	<p>Within median of I-290</p> <p>Within median of I-290</p>	<p>CTA has indicated that they may remove or relocate the electrified third rail within the bridge and barrier wall reconstruction limits. Contractor must coordinate with CTA.</p> <p>Main signal ductbanks are located in the center of the right of way and along the underside of the platform. An impedance bond is located at track level approximately at the west fascia beam of the Peoria Bridge adjacent to Pier 1. The main signal ductbank runs approximately 16 feet north of the WB track.</p>	<p>Any relocation to be coordinated by Contractor during construction.</p> <p>All components to be protected and not disturbed by the Contractor during construction. Contractor to provide documentation to IDOT / CTA on protection measures of any work within 10 feet of a signal component.</p>

CTA (continued)	Communications	Within median of I-290	Main communications fiber is located in a ductbank below the platform throughout the project limits.	Provide a temporary service and relocate ductback by the Contractor during construction.
	Water / Sewer Service	Within median of I-290	Water / sewer connections are provided to CTA within I-290. Sewer connects within the barrier walls. Water connection is TBD. Contract requires new station house connections at where they transition below grade. Contractor to coordinate with CTA to protect underground connections during work.	Protect by the Contractor during construction.

The above represents the best information available to the Department and is included for the convenience of the bidder. The applicable portions of Articles 105.07 and 107.31 of the Standard Specifications shall apply.

In accordance with 605 ILCS 5/9-113 of the Illinois Compiled Statutes, utility companies have 90 days to complete the relocation of their facilities after receipt of written notice from the Department. The 90-day written notice will be sent to the utility companies after the following occurs:

- 1) Proposed right of way is clear for contract award.
- 2) Final plans have been sent to and received by the utility company.
- 3) Utility permit is received by the Department and the Department is ready to issue said permit.
- 4) If a permit has not been submitted, a 15 day letter is sent to the utility company notifying them they have 15 days to provide their permit application. After allowing 15 days for submission of the permit the 90 day notice is sent to the utility company.
- 5) Any time within the 90 day relocation period the utility company may request a waiver for additional time to complete their relocation. The Department has 10 days to review and respond to a waiver request.

RESTRICTION ON WORKING DAYS AFTER A COMPLETION DATE

All temporary lane closures *on arterial streets*, which shall consist of Harrison Street, during the period governed by working days after a completion date will not be permitted during the hours of 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m. Monday through Friday.

All lane closure signs shall not be erected any earlier than one-half (1/2) hour before the starting hours listed above. Also, these signs should be taken down within one-half (1/2) hour after the closure is removed.

FAILURE TO COMPLETE THE WORK ON TIME

Should the Contractor fail to complete the work on or before the completion date as specified in the Special Provision for "Completion Date Plus Working Days", or within such extended time as may have been allowed by the Department, the Contractor shall be liable to the Department in the amount of **\$10,000**, not as a penalty but as liquidated damages, for each calendar day or a portion thereof of overrun in the contract time or such extended time as may have been allowed.

Should the Contractor fail to complete the work necessary to open the bridge as shown in the plans for temporary pedestrian access across the east side of the bridge on or before the completion date as specified in the Special Provision for "Completion Date Plus Working Days", or within such extended time as may have been allowed by the Department, the Contractor shall be liable to the Department in the amount of **\$10,000**, not as a penalty but as liquidated damages, for each calendar day or a portion thereof of overrun in the contract time or such extended time as may have been allowed.

In fixing the damages as set out herein, the desire is to establish a certain mode of calculation for the work since the Department's actual loss, in the event of delay, cannot be predetermined, would be difficult of ascertainment, and a matter of argument and unprofitable litigation. This said mode is an equitable rule for measurement of the Department's actual loss and fairly takes into account the loss of use of the roadway if the project is delayed in completion. The Department shall not be required to provide any actual loss in order to recover these liquidated damages provided herein, as said damages are very difficult to ascertain. Furthermore, no provision of this clause shall be construed as a penalty, as such is not the intention of the parties.

A calendar day is every day shown on the calendar and starts at 12:00 midnight and ends at the following 12:00 midnight, twenty-four hours later.

COMPLETION DATE PLUS WORKING DAYS

Revise Article 108.05 (b) of the Standard Specifications as follows:

"When a completion date plus working days is specified, the Contractor shall complete all contract items and safely open all roadways to traffic and the Peoria Street access to the UIC-Halsted CTA Station to transit users by 11:59 PM on May 31, 2015 except as specified herein.

All the work consisting of the Peoria Street Bridge (SN 016-1708) construction must be completed to open the bridge as shown in the plans for temporary pedestrian access across the east side of the bridge on or before November 15, 2014.

The Contractor will be allowed to complete all clean-up work and punch list items within 10 working days after the completion date for opening the roadway to traffic. Under extenuating circumstances the Engineer may direct that certain items of work, not affecting the safe opening of the roadway to traffic, may be completed within the working days allowed for cleanup work and punch list items. Temporary lane closures for this work may be allowed at the discretion of the Engineer."

Article 108.09 or the Special Provision for "Failure to Complete the Work on Time", if included in this contract, shall apply to both the completion date and the number of working days.

TRAFFIC CONTROL AND PROTECTION (ARTERIALS)

Effective: February 1, 1996

Revised: March 1, 2011

Specific traffic control plan details and Special Provisions have been prepared for this contract. This work shall include all labor, materials, transportation, handling and incidental work necessary to furnish, install, maintain and remove all traffic control devices required as indicated in the plans and as approved by the Engineer.

When traffic is to be directed over a detour route, the Contractor shall furnish, erect, maintain and remove all applicable traffic control devices along the detour route according to the details shown in the plans.

Method of Measurement: All traffic control (except "Traffic Control and Protection (Expressways)" and temporary pavement markings) indicated on the traffic control plan details and specified in the Special Provisions will be measured for payment on a lump sum basis.

Basis of Payment: All traffic control and protection will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (SPECIAL).

Temporary pavement markings will be paid for separately unless shown on a Standard.

TRAFFIC CONTROL PLAN

Traffic Control shall be according to the applicable sections of the Standard Specifications, the Supplemental Specifications, the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways", any special details and Highway Standards contained in the plans, and the Special Provisions contained herein.

Special attention is called to Article 107.09 of the Standard Specifications and the following Highway Standards, Details, Quality Standard for Work Zone Traffic Control Devices, Recurring Special Provisions and Special Provisions contained herein, relating to traffic control.

The Contractor shall contact the District One Bureau of Traffic at least 72 hours in advance of beginning work.

STANDARDS: 701101, 701400, 701401, 701411, 701428, 701446, 701601, 701801, 701901, 704001

DETAILS: Suggested Stages of Construction and Traffic Control Plan – General Notes, Narrative, Typical Sections, Stages 1A, 1B, 2 and 3, District Details TC-08, TC-09, TC-10, TC-11, TC-12, TC-17, and TC-18.

SPECIAL PROVISIONS:

Suggested Stages of Construction and Traffic Control Plan,
Maintenance of Roadways,
Staging and Interchange Restrictions,
Traffic Control and Protection (Arterials),
Public Convenience and Safety,
Keeping the Expressway Open to Traffic,
Failure to Open Traffic Lanes to Traffic,
Traffic Control and Protection (Expressways),
Traffic Control Surveillance, Expressways,
Temporary Information Signing,
Traffic Control for Work Zone Areas,
Traffic Control Setup and Removal Freeway/Expressway (BDE)

ADJUSTMENTS AND RECONSTRUCTIONS

Effective: March 15, 2011

Revise the first paragraph of Article 602.04 to read:

“602.04 Concrete. Cast-in-place concrete for structures shall be constructed of Class SI concrete according to the applicable portions of Section 503. Cast-in-place concrete for pavement patching around adjustments and reconstructions shall be constructed of Class PP-1 concrete, unless otherwise noted in the plans, according to the applicable portions of Section 1020.”

Revise the third, fourth and fifth sentences of the second paragraph of Article 602.11(c) to read:

“Castings shall be set to the finished pavement elevation so that no subsequent adjustment will be necessary, and the space around the casting shall be filled with Class PP-1 concrete, unless otherwise noted in the plans, to the elevation of the surface of the base course or binder course. HMA surface or binder course material shall not be allowed. The pavement may be opened to traffic according to Article 701.17(e)(3)b.”

Revise Article 603.05 to read:

“603.05 Replacement of Existing Flexible Pavement. After the castings have been adjusted, the surrounding space shall be filled with Class PP-1 concrete, unless otherwise noted in the plans, to the elevation of the surface of the base course or binder course. HMA surface or binder course material shall not be allowed. The pavement may be opened to traffic according to Article 701.17(e)(3)b.”

Revise Article 603.06 to read:

“603.06 Replacement of Existing Rigid Pavement. After the castings have been adjusted, the pavement and HMA that was removed, shall be replaced with Class PP-1 concrete, unless otherwise noted in the plans, not less than 9 in. (225 mm) thick. The pavement may be opened to traffic according to Article 701.17(e)(3)b.

The surface of the Class PP concrete shall be constructed flush with the adjacent surface.”

Revise the first sentence of Article 603.07 to read:

“603.07 Protection Under Traffic. After the casting has been adjusted and the Class PP concrete has been placed, the work shall be protected by a barricade and two lights according to Article 701.17(e)(3)b.”

AGGREGATE FOR CONCRETE BARRIER (D-1)

Effective: March 11, 2004
Revised: January 24, 2008

Add the following paragraph to Article 637.02 of the Standard Specifications:

“The coarse aggregate to be used in the concrete barrier walls shall conform to the requirement for coarse aggregate used in Class BS concrete according to Article 1004.01(b), paragraph 2.”

AGGREGATE SUBGRADE IMPROVEMENT (D-1)

Effective: February 22, 2012
Revised: November 1, 2013

Add the following Section to the Standard Specifications:

“SECTION 303. AGGREGATE SUBGRADE IMPROVEMENT

303.01 Description. This work shall consist of constructing an aggregate subgrade improvement.

303.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Coarse Aggregate	1004
(b) Reclaimed Asphalt Pavement (RAP) (Notes 1, 2 and 3)	1031

Note 1. Crushed RAP, from either full depth or single lift removal, may be mechanically blended with aggregate gradations CS 01 or CS 02 but shall not exceed 40 percent of the total product. The top size of the Coarse RAP shall be less than 4 in. (100 mm) and well graded.

Note 2. RAP having 100 percent passing the 1 1/2 in. (37.5 mm) sieve and being well graded, may be used as capping aggregate in the top 3 in. (75 mm) when aggregate gradations CS 01 or CS 02 are used in lower lifts. When RAP is blended with any of the coarse aggregates, the blending shall be done with mechanically calibrated feeders.

Note 3. The RAP used for aggregate subgrade improvement shall be according to the current Bureau of Materials and Physical Research Policy Memorandum, “Reclaimed Asphalt Pavement (RAP) for Aggregate Applications”.

303.03 Equipment. The vibratory machine shall be according to Article 1101.01, or as approved by the Engineer.

303.04 Soil Preparation. The stability of the soil shall be according to the Department’s Subgrade Stability Manual for the aggregate thickness specified.

303.05 Placing Aggregate. The maximum nominal lift thickness of aggregate gradations CS 01 or CS 02 shall be 24 in. (600 mm).

303.06 Capping Aggregate. The top surface of the aggregate subgrade shall consist of a minimum 3 in. (75 mm) of aggregate gradations CA 06 or CA 10. When Reclaimed Asphalt Pavement (RAP) is used, it shall be crushed and screened where 100 percent is passing the 1 1/2 in. (37.5 mm) sieve and being well graded. RAP that has been fractionated to size will not be permitted for use in capping. Capping aggregate will not be required when the aggregate subgrade improvement is used as a cubic yard pay item for undercut applications. When RAP is blended with any of the coarse aggregates, the blending shall be done with mechanically calibrated feeders.

303.07 Compaction. All aggregate lifts shall be compacted to the satisfaction of the Engineer. If the moisture content of the material is such that compaction cannot be obtained, sufficient water shall be added so that satisfactory compaction can be obtained.

303.08 Finishing and Maintenance of Aggregate Subgrade Improvement. The aggregate subgrade improvement shall be finished to the lines, grades, and cross sections shown on the plans, or as directed by the Engineer. The aggregate subgrade improvement shall be maintained in a smooth and compacted condition.

303.09 Method of Measurement. This work will be measured for payment according to Article 311.08.

303.10 Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) for AGGREGATE SUBGRADE IMPROVEMENT or at the contract unit price per square yard (square meter) for AGGREGATE SUBGRADE IMPROVEMENT, of the thickness specified.

Add the following to Section 1004 of the Standard Specifications:

“1004.06 Coarse Aggregate for Aggregate Subgrade Improvement. The aggregate shall be according to Article 1004.01 and the following.

- (a) Description. The coarse aggregate shall be crushed gravel, crushed stone, or crushed concrete.
- (b) Quality. The coarse aggregate shall consist of sound durable particles reasonably free of deleterious materials.

(c) Gradation.

- (1) The coarse aggregate gradation for total subgrade thicknesses of 12 in. (300 mm) or greater shall be CS 01 or CS 02.

Grad No.	COARSE AGGREGATE SUBGRADE GRADATIONS				
	Sieve Size and Percent Passing				
	8"	6"	4"	2"	#4
CS 01	100	97 ± 3	90 ± 10	45 ± 25	20 ± 20
CS 02		100	80 ± 10	25 ± 15	

Grad No.	COARSE AGGREGATE SUBGRADE GRADATIONS (Metric)				
	Sieve Size and Percent Passing				
	200 mm	150 mm	100 mm	50 mm	4.75 mm
CS 01	100	97 ± 3	90 ± 10	45 ± 25	20 ± 20
CS 02		100	80 ± 10	25 ± 15	

- (2) The 3 in. (75 mm) capping aggregate shall be gradation CA 6 or CA 10.

- (3) Gradation deleterious count shall not exceed 10% of total RAP and 5% of other by total weight.

COARSE AGGREGATE FOR BACKFILL, TRENCH BACKFILL AND BEDDING (D-1)

Effective: November 1, 2011

Revised: November 1, 2013

This work shall be according to Section 1004.05 of the Standard Specifications except for the following:

Reclaimed Asphalt Pavement (RAP) maybe blended with gravel, crushed gravel, crushed stone crushed concrete, crushed slag, chats, crushed sand stone or wet bottom boiler slag. The RAP used shall be according to the current Bureau of Materials and Physical Research Policy Memorandum, "Reclaimed Asphalt Pavement (RAP) for Aggregate Applications". The RAP shall be uniformly graded and shall pass the 1.0 in. (25 mm) screen. When RAP is blended with any of the coarse aggregate listed above, the blending shall be done mechanically with calibrated feeders. The feeders shall have an accuracy of ± 2.0 percent of the actual quantity of material delivered. The final blended product shall not contain more than 40 percent by weight RAP.

The coarse aggregate listed above shall meet CA 6 and CA 10 gradations prior to being blended with the processed and uniformly graded RAP. Gradation deleterious count shall not exceed 10% of total RAP and 5% of other by total weight.

DRAINAGE AND INLET PROTECTION UNDER TRAFFIC (DISTRICT 1)

Effective: April 1, 2011

Revised: April 2, 2011

Add the following to Article 603.02 of the Standard Specifications:

- “ (i) Temporary Hot-Mix Asphalt (HMA) Ramp (Note)..... 1030
- (j) Temporary Rubber Ramps (Note 2)

Note 1. The HMA shall have maximum aggregate size of 3/8 in. (95 mm).

Note 2. The rubber material shall be according to the following.

Property	Test Method	Requirement
Durometer Hardness, Shore A	ASTM D 2240	75 ±15
Tensile Strength, psi (kPa)	ASTM D 412	300 (2000) min
Elongation, percent	ASTM D 412	90 min
Specific Gravity	ASTM D 792	1.0 - 1.3
Brittleness, °F (°C)	ASTM D 746	-40 (-40)”

Revise Article 603.07 of the Standard Specifications to read:

“ **603.07 Protection Under Traffic.** After the casting has been adjusted and the Class PP concrete has been placed, the work shall be protected by a barricade and two lights according to Article 701.17(e)(3)b.

When castings are under traffic before the final surfacing operation has been started, properly sized temporary ramps shall be placed around the drainage and/or utility castings according to the following methods.

- (a) Temporary Asphalt Ramps. Temporary hot-mix asphalt ramps shall be placed around the casting, flush with its surface and decreasing to a featheredge in a distance of 2 ft (600 mm) around the entire surface of the casting.
- (b) Temporary Rubber Ramps. Temporary rubber ramps shall only be used on roadways with permanent posted speeds of 40 mph or less and when the height of the casting to be protected meets the proper sizing requirements for the rubber ramps as shown below.

Dimension	Requirement
Inside Opening	Outside dimensions of casting + 1 in. (25 mm)
Thickness at inside edge	Height of casting \pm 1/4 in. (6 mm)
Thickness at outside edge	1/4 in. (6 mm) max.
Width, measured from inside opening to outside edge	8 1/2 in. (215 mm) min

Placement shall be according to the manufacturer's specifications.

Temporary ramps for castings shall remain in place until surfacing operations are undertaken within the immediate area of the structure. Prior to placing the surface course, the temporary ramp shall be removed. Excess material shall be disposed of according to Article 202.03."

EMBANKMENT 1

Effective: March 1, 2011

Revised: November 1, 2013

Description. This work shall be according to Section 205 of the Standard Specifications except for the following.

Material. All material shall be approved by the District Geotechnical Engineer. The proposed material must meet the following requirements.

- a) The laboratory Standard Dry Density shall be a minimum of 90 lb/cu ft (1450 kg/cu m) when determined according to AASHTO T 99 (Method C).
- b) The organic content shall be less than ten percent determined according to AASHTO T 194 (Wet Combustion).
- c) Soils which demonstrate the following properties shall be restricted to the interior of the embankment and shall be covered on both the sides and top of the embankment by a minimum of 3 ft (900 mm) of soil not considered detrimental in terms of erosion potential or excess volume change.
 - 1) A grain size distribution with less than 35 percent passing the number 75 um (#200) sieve.
 - 2) A plasticity index (PI) of less than 12.
 - 3) A liquid limit (LL) in excess of 50.
- d) Reclaimed asphalt shall not be used within the ground water table or as a fill if ground water is present.

- e) The RAP used shall be according to the current Bureau of Materials and Physical Research Policy Memorandum, "Reclaimed Asphalt Pavement (RAP) for Aggregate Applications". Gradation deleterious count shall not exceed 10% of total RAP and 5% of other by total weight.

CONSTRUCTION REQUIREMENTS

Samples. Embankment material shall be sampled, tested, and approved before use. The contractor shall identify embankment sources, and provide equipment as the Engineer requires, for the collection of samples from those sources. Samples will be furnished to the Geotechnical Engineer a minimum of three weeks prior to use in order that laboratory tests for approval and compaction can be performed. Embankment material placement cannot begin until tests are completed and approval given.

Placing Material. In addition to Article 202.03, broken concrete, reclaimed asphalt with no expansive aggregate, or uncontaminated dirt and sand generated from construction or demolition activities shall be placed in 6 inches (150 mm) lifts and disked with the underlying lift until a uniform homogenous material is formed. This process also applies to the overlaying lifts. The disk must have a minimum blade diameter of 24 inches (600 mm).

When embankments are to be constructed on hillsides or existing slopes that are steeper than 3H:1V, steps shall be keyed into the existing slope by stepping and benching as shown in the plans or as directed by the engineer.

Compaction. Soils classification for moisture content control will be determined by the Soils Inspector using visual field examination techniques and the IDH Textural Classification Chart.

When tested for density in place each lift shall have a maximum moisture content as follows.

- a) A maximum of 110 percent of the optimum moisture for all forms of clay soils.
- b) A maximum of 105 percent of the optimum moisture for all forms of clay loam soils.

Stability. The requirement for embankment stability in Article 205.04 will be measured with a Dynamic Cone Penetrometer (DCP) according to the test method in the IDOT Geotechnical Manual. The penetration rate must be equal or less than 1.5 inches (38 mm) per blow.

Basis of Payment. This work will not be paid separately but will be considered as included in the various items of excavation.

FINE AGGREGATE FOR HOT-MIX ASPHALT (HMA) (D-1)

Effective: May 01, 2007

Revised: January 1, 2012

Revise Article 1003.03 (c) of the Standard Specifications to read:

“(c) Gradation. The fine aggregate gradation for all HMA shall be FA1, FA 2, FA 20, FA 21 or FA 22. When Reclaimed Asphalt Pavement (RAP) is incorporated in the HMA design, the use of FA 21 Gradation will not be permitted.

FRICITION SURFACE AGGREGATE (D-1)

Effective: January 1, 2011
 Revised: November 1, 2013

Revise Article 1004.01(a)(4) of the Standard Specifications to read:

- “ (4) Crushed Stone. Crushed stone shall be the angular fragments resulting from crushing undisturbed, consolidated deposits of rock by mechanical means. Crushed stone shall be divided into the following, when specified.
- a. Carbonate Crushed Stone. Carbonate crushed stone shall be either dolomite or limestone. Dolomite shall contain 11.0 percent or more magnesium oxide (MgO). Limestone shall contain less than 11.0 percent magnesium oxide (MgO).
 - b. Crystalline Crushed Stone. Crystalline crushed stone shall be either metamorphic or igneous stone, including but is not limited to, quartzite, granite, rhyolite and diabase.”

Revise Article 1004.03(a) of the Standard Specifications to read:

“1004.03 Coarse Aggregate for Hot-Mix Asphalt (HMA). The aggregate shall be according to Article 1004.01 and the following revisions.

(a) Description. The coarse aggregate for HMA shall be according to the following table.

Use	Mixture	Aggregates Allowed
Class A	Seal or Cover	<u>Allowed Alone or in Combination:</u> Gravel Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag Crushed Concrete
HMA All Other	Shoulders	<u>Allowed Alone or in Combination:</u> Gravel Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/} Crushed Concrete

Use	Mixture	Aggregates Allowed	
HMA High ESAL Low ESAL	C Surface IL-12.5,IL-9.5, or IL-9.5L	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/} Crushed Concrete	
HMA High ESAL	D Surface IL-12.5 or IL-9.5	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone (other than Limestone) Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/} Crushed Concrete	
		<u>Other Combinations Allowed:</u>	
		<i>Up to...</i>	<i>With...</i>
		25% Limestone	Dolomite
		50% Limestone	Any Mixture D aggregate other than Dolomite
HMA High ESAL	F Surface IL-12.5 or IL-9.5	<u>Allowed Alone or in Combination:</u> Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/} No Limestone or no Crushed Gravel alone.	
		<u>Other Combinations Allowed:</u>	
<i>Up to...</i>	<i>With...</i>		

Use	Mixture	Aggregates Allowed	
		50% Crushed Gravel, or Dolomite	Crushed Sandstone, Crushed Slag (ACBF) ^{1/} , Crushed Steel Slag ^{1/} , or Crystalline Crushed Stone
HMA High ESAL	SMA Ndesign 80 Surface	Crystalline Crushed Stone Crushed Sandstone Crushed Steel Slag	

1/ When either slag is used, the blend percentages listed shall be by volume.

Add the following to Article 1004.03 (b):

“ When using Crushed Concrete, the quality shall be determined as follows. The Contractor shall obtain a representative sample from the stockpile, witnessed by the Engineer, at a frequency of 2500 tons (2300 metric tons). The sample shall be a minimum of 50 lb (25 kg). The Contractor shall submit the sample to the District Office. The District will forward the sample to the BMPR Aggregate Lab for MicroDeval Testing, according to Illinois Modified AASHTO T 327. A maximum loss of 15.0 percent by weight will be applied for acceptance. The stockpile shall be sealed until test results are complete and found to meet the specifications above.”

GROUND TIRE RUBBER (GTR) MODIFIED ASPHALT BINDER (D-1)

Effective: June 29, 2006

Revised: January 01, 2013

Add the following to the end of article 1032.05 of the Standard Specifications:

“(c) Ground Tire Rubber (GTR) Modified Asphalt Binder. A quantity of 10.0 to 14.0 percent GTR (Note 1) shall be blended by dry unit weight with a PG 64-28 to make a GTR 70-28 or a PG 58-28 to make a GTR 64-28. The base PG 64-28 and PG 58-28 asphalt binders shall meet the requirements of Article 1032.05(a). Compatible polymers may be added during production. The GTR modified asphalt binder shall meet the requirements of the following table.

Test	Asphalt Grade GTR 70-28	Asphalt Grade GTR 64-28
Flash Point (C.O.C.), AASHTO T 48, °F (°C), min.	450 (232)	450 (232)
Rotational Viscosity, AASHTO T 316 @ 275 °F (135 °C), Poises, Pa-s, max.	30 (3)	30 (3)
Softening Point, AASHTO T 53, °F (°C), min.	135 (57)	130 (54)
Elastic Recovery, ASTM D 6084, Procedure A (sieve waived) @ 77 °F, (25 °C), aged, ss, 100 mm elongation, 5 cm/min., cut immediately, %, min.	65	65

Note 1. GTR shall be produced from processing automobile and/or light truck tires by the ambient grinding method. GTR shall not exceed 1/16 in. (2 mm) in any dimension and shall contain no free metal particles or other materials. A mineral powder (such as talc) meeting the requirements of AASHTO M 17 may be added, up to a maximum of four percent by weight of GTR to reduce sticking and caking of the GTR particles. When tested in accordance with Illinois modified AASHTO T 27, a 50 g sample of the GTR shall conform to the following gradation requirements:

Sieve Size	Percent Passing
No. 16 (1.18 mm)	100
No. 30 (600 μm)	95 ± 5
No. 50 (300 μm)	> 20

Add the following to the end of Note 1. of article 1030.03 of the Standard Specifications:

“A dedicated storage tank for the Ground Tire Rubber (GTR) modified asphalt binder shall be provided. This tank must be capable of providing continuous mechanical mixing throughout by continuous agitation and recirculation of the asphalt binder to provide a uniform mixture. The tank shall be heated and capable of maintaining the temperature of the asphalt binder at 300 °F to 350 °F (149 °C to 177 °C). The asphalt binder metering systems of dryer drum plants shall be calibrated with the actual GTR modified asphalt binder material with an accuracy of ± 0.40 percent.”

Revise 1030.02(c) of the Standard Specifications to read:

“(c) RAP Materials (Note 3)1031”

Add the following note to 1030.02 of the Standard Specifications:

Note 3. When using reclaimed asphalt pavement and/or reclaimed asphalt shingles, the maximum asphalt binder replacement percentage shall be according to the most recent special provision for recycled materials.

HEAT OF HYDRATION CONTROL FOR CONCRETE STRUCTURES (D-1)

Effective: November 1, 2013

Article 1020.15 shall not apply.

HMA MIXTURE DESIGN REQUIREMENTS (D-1)

Effective: January 1, 2013

Revised: November 1, 2013

Revise Article 406.14(b) of the Standard Specifications to read.

“(b) If the HMA placed during the initial test strip (1) is determined to be unacceptable to remain in place by the Engineer, and (2) was not produced within 2.0 to 6.0 percent air voids or within the individual control limits of the JMF, the mixture and test strip will not be paid for and the mixture shall be removed at the Contractor’s expense. An additional test strip and mixture will be paid for in full, if produced within 2.0 to 6.0 percent air voids and within the individual control limits of the JMF.”

Revise Article 406.14(c) of the Standard Specifications to read.

“(c) If the HMA placed during the initial test strip (1) is determined to be unacceptable to remain in place by the Engineer, and (2) was produced within 2.0 to 6.0 percent air voids and within the individual control limits of the JMF, the mixture shall be removed. Removal will be paid in accordance to Article 109.04 of the Standard Specifications. This initial mixture and test strip will be paid for at the contract unit prices. The additional mixture will be paid for at the contract unit price, and any additional test strips will be paid for at one half the unit price of each test strip.”

1) Design Composition and Volumetric Requirements

Revise the following table in Article 1030.01 of the Standard Specifications to read.

High ESAL	IL-25.0 binder; IL-19.0 binder; IL-12.5 surface; IL-9.5 surface; IL-4.75, SMA
-----------	--

Revise the following table in Article 1030.04(a)(1):

“(1) High ESAL Mixtures. The Job Mix Formula (JMF) shall fall within the following limits.

High ESAL, MIXTURE COMPOSITION (% PASSING) ^{1/}														
Sieve Size	IL-25.0 mm		IL-19.0 mm		IL-12.5 mm		IL-9.5 mm		IL-4.75 mm		SMA ^{4/} IL-12.5 mm		SMA ^{4/} IL-9.5 mm	
	Min	max	min	max	min	max	min	max	min	max	min	max	min	max
1 1/2 in (37.5 mm)		100												
1 in. (25 mm)	90	100		100										
3/4 in. (19 mm)		90	82	100		100						100		
1/2 in. (12.5 mm)	45	75	50	85	90	100		100		100	80	100		100
3/8 in. (9.5 mm)						89	90	100		100		65	90	100
#4 (4.75 mm)	24	42 ^{2/}	24	50 ^{2/}	28	65	32	69	90	100	20	30	36	50
#8 (2.36 mm)	16	31	20	36	28	48 ^{3/}	32	52 ^{3/}	70	90	16	24 ^{5/}	16	32
#16 (1.18 mm)	10	22	10	25	10	32	10	32	50	65				
#30 (600 μm)											12	16	12	18
#50 (300 μm)	4	12	4	12	4	15	4	15	15	30				
#100 (150 μm)	3	9	3	9	3	10	3	10	10	18				
#200 (75 μm)	3	6	3	6	4	6	4	6	7	9 ^{6/}	7.0	9.0 ^{6/}	7.5	9.5 ^{6/}
Ratio Dust/Asphalt Binder		1.0		1.0		1.0		1.0		1.0		1.5		1.5

- 1/ Based on percent of total aggregate weight.
- 2/ The mixture composition shall not exceed 40 percent passing the #4 (4.75 mm) sieve for binder courses with Ndesign ≥ 90.
- 3/ The mixture composition shall not exceed 44 percent passing the #8 (2.36 mm) sieve for surface courses with Ndesign ≥ 90.
- 4/ The maximum percent passing the 20 μm sieve shall be ≤ 3 percent.
- 5/ When establishing the Adjusted Job Mix Formula (AJMF) the #8 (2.36mm) sieve shall not be adjusted above 24 percent.
- 6/ Additional minus No. 200 (0.075 mm) material required by the mix design shall be mineral filler, unless otherwise approved by the Engineer.”

Delete Article 1030.04(a)(4) of the Standard Specifications.

Revise Article 1030.04(b)(1) of the Standard Specifications to read.

“(1) High ESAL Mixtures. The target value for the air voids of the HMA shall be 4.0 percent and for IL-4.75 it shall be 3.5 percent at the design number of gyrations. The VMA and VFA of the HMA design shall be based on the nominal maximum size of the aggregate in the mix, and shall conform to the following requirements.

VOLUMETRIC REQUIREMENTS High ESAL						
Ndesign	Voids in the Mineral Aggregate (VMA), % minimum					Voids Filled with Asphalt Binder (VFA), %
	IL-25.0	IL-19.0	IL-12.5	IL-9.5	IL-4.75 ^{1/}	
50	12.0	13.0	14.0	15.0	18.5	65 – 78 ^{2/}
70					65 - 75	
90						
105						

1/ Maximum Draindown for IL-4.75 shall be 0.3%

2/ VFA for IL-4.75 shall be 72-85%”

Delete Article 1030.04(b) (4) of the Standard Specifications.

Revise table in Article 1030.04(b)(5) as follows:

“(5) SMA Mixtures.

Volumetric Requirements SMA ^{1/}			
Ndesign	Design Air Voids Target %	Voids in the Mineral Aggregate (VMA), % min.	Voids Filled with Asphalt (VFA), %
80 ^{4/}	3.5	17 ^{2/}	75 - 83
		16 ^{3/}	

1/ Maximum Draindown shall be 0.3%.

2/ Applies when specific gravity of coarse aggregate is ≥ 2.760 .

3/ Applies when specific gravity of coarse aggregate is < 2.760 .

- 4/ For surface course, coarse aggregate shall be Class B Quality; the coarse aggregate can be crushed steel slag, crystalline crushed stone or crushed sandstone.*

For binder course, coarse aggregate shall be crushed stone (dolomite), crushed gravel, crystalline crushed stone, or crushed sandstone.*

*Blending of different types of aggregate will not be permitted.

2) Design Verification and Production

Description. The following states the requirements for Hamburg Wheel and Tensile Strength testing for High ESAL, IL-4.75, and Stone Matrix Asphalt (SMA) hot-mix asphalt (HMA) mixes during mix design verification and production.

When the options of Warm Mix Asphalt, Reclaimed Asphalt Shingles, or Reclaimed Asphalt Pavement are used by the Contractor, the Hamburg Wheel and tensile strength requirements in this special provision will be superseded by the special provisions for Warm Mix Asphalt and/or by the District special provision for Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles as applicable.

Mix Design Testing. Add the following to Article 1030.04 of the Standard Specifications:

- “(d) Verification Testing. High ESAL, IL-4.75, and SMA mix designs submitted for verification will be tested to ensure that the resulting mix designs will pass the required criteria for the Hamburg Wheel Test (IL mod AASHTO T-324) and the Tensile Strength Test (IL mod AASHTO T-283). The Department will perform a verification test on gyratory specimens compacted by the Contractor. If the mix fails the Department’s verification test, the Contractor shall make the necessary changes to the mix and resubmit compacted specimens to the Department for verification. If the mix fails again, the mix design will be rejected.

All new and renewal mix designs will be required to be tested, prior to submittal for Department verification meeting the following requirements:

- (1)Hamburg Wheel Test criteria.

Asphalt Binder Grade	# Repetitions	Max Rut Depth (mm)
PG 70 -XX (or higher)	20,000	12.5
PG 64 -XX (or lower)	10,000	12.5

Note: For SMA Designs (N-80) the maximum rut depth is 6.0 mm at 20,000 repetitions.

For IL 4.75mm Designs (N-50) the maximum rut depth is 9.0mm at 15,000 repetitions.

- (2) Tensile Strength Criteria. The minimum allowable conditioned tensile strength shall be 415 kPa (60 psi) for non-polymer modified performance graded (PG) asphalt binder and 550 kPa (80 psi) for polymer modified PG asphalt binder. The maximum allowable unconditioned tensile strength shall be 1380 kPa (200 psi).”

Production Testing.

Revise first paragraph of Article 1030.06(a) to read:

- “(a) High ESAL and IL-4.75 Mixtures. For each contract, a 300 ton (275 metric tons) test strip, except for IL -4.75 it will be 400 ton (363 metric ton), will be required at the beginning of HMA production for each mixture with a quantity of 3000 tons (2750 metric tons) or more according to the Manual of Test Procedures for Materials “Hot Mix Asphalt Test Strip Procedures”.”

Delete second paragraph of Article 1030.06 (a).

Revise first sentence in fourth paragraph of Article 1030.06 (a) to read:

“Before constructing the test strip, target values shall be determined by applying gradation correction factors to the JMF when applicable.”

Mixture sampled to represent the test strip shall include additional material sufficient for the Department to conduct Hamburg Wheel testing according to Illinois Modified AASHTO T324 (approximately 60 lb (27 kg) total).

Add the following to Article 1030.06 of the Standard Specifications:

- “(c) Hamburg Wheel Test. All HMA mixtures shall be sampled within the first 500 tons (450 metric tons) on the first day of production or during start up with a split reserved for the Department. The mix sample shall be tested according to the Illinois Modified AASHTO T 324 and shall meet the requirements specified herein. Mix production shall not exceed 1500 tons (1350 metric tons) or one day’s production, whichever comes first, until the testing is completed and the mixture is found to be in conformance. The requirement to cease mix production may be waived if the plant produced mixture demonstrates conformance prior to start of mix production for a contract. The Department may conduct additional Hamburg Wheel Tests on production material as determined by the Engineer. If the mixture fails to meet the Hamburg Wheel criteria, no further mixture will be accepted until the Contractor takes such action as is necessary to furnish a mixture meeting the criteria”

The Contractor shall immediately cease production upon notification by the Engineer of failing Hamburg Wheel test. All prior produced material may be paved out provided all other mixture criteria are being met. No additional mixture shall be produced until the Engineer receives passing Hamburg Wheel tests.

Basis of Payment. Revise the seventh paragraph of Article 406.14 of the Standard Specifications to read:

“For all mixes designed and verified under the Hamburg Wheel criteria, the cost of furnishing and introducing anti-stripping additives in the HMA will not be paid for separately, but shall be considered as included in the contract unit price of the HMA item involved.

No additional compensation will be awarded to the Contractor because of reduced production rates associated with the addition of the anti-stripping additive.”

PUBLIC CONVENIENCE AND SAFETY (D-1)

Effective: May 1, 2012

Revised: July 15, 2012

Add the following to the end of the fourth paragraph of Article 107.09:

“If the holiday is on a Saturday or Sunday, and is legally observed on a Friday or Monday, the length of Holiday Period for Monday or Friday shall apply.”

Add the following sentence after the Holiday Period table in the fourth paragraph of Article 107.09:

“The length of Holiday Period for Thanksgiving shall be from 5:00 AM the Wednesday prior to 11:59 PM the Sunday after”

Delete the fifth paragraph of Article 107.09 of the Standard Specifications:

“On weekends, excluding holidays, roadways with Average Daily Traffic of 25,000 or greater, all lanes shall be open to traffic from 3:00 P.M. Friday to midnight Sunday except where structure construction or major rehabilitation makes it impractical.”

RECLAIMED ASPHALT PAVEMENT AND RECLAIMED ASPHALT SHINGLES (D-1)

Effective: November 1, 2012

Revise: November 1, 2013

Revise Section 1031 of the Standard Specifications to read:

SECTION 1031. RECLAIMED ASPHALT PAVEMENT AND RECLAIMED ASPHALT SHINGLES

1031.01 Description. Reclaimed asphalt pavement and reclaimed asphalt shingles shall be according to the following.

- (a) Reclaimed Asphalt Pavement (RAP). RAP is the material resulting from cold milling or crushing an existing hot-mix asphalt (HMA) pavement. RAP will be considered processed FRAP after completion of both crushing and screening to size. The Contractor shall supply written documentation that the RAP originated from routes or airfields under federal, state, or local agency jurisdiction.
- (b) Reclaimed Asphalt Shingles (RAS). Reclaimed asphalt shingles (RAS). RAS is from the processing and grinding of preconsumer or post-consumer shingles. RAS shall be a clean and uniform material with a maximum of 0.5 percent unacceptable material, as defined in Bureau of Materials and Physical Research Policy Memorandum "Reclaimed Asphalt Shingle (RAS) Sources", by weight of RAS. All RAS used shall come from a Bureau of Materials and Physical Research approved processing facility where it shall be ground and processed to 100 percent passing the 3/8 in. (9.5 mm) sieve and 90 percent passing the #4 (4.75 mm) sieve. RAS shall meet the testing requirements specified herein. In addition, RAS shall meet the following Type 1 or Type 2 requirements.
- (1) Type 1. Type 1 RAS shall be processed, preconsumer asphalt shingles salvaged from the manufacture of residential asphalt roofing shingles.
- (2) Type 2. Type 2 RAS shall be processed post-consumer shingles only, salvaged from residential, or four unit or less dwellings not subject to the National Emission Standards for Hazardous Air Pollutants (NESHAP).

1031.02 Stockpiles. RAP and RAS stockpiles shall be according to the following.

- (a) RAP Stockpiles. The Contractor shall construct individual, sealed RAP stockpiles meeting one of the following definitions. Additional processed RAP (FRAP) shall be stockpiled in a separate working pile, as designated in the QC Plan, and only added to the sealed stockpile when test results for the working pile are complete and are found to meet tolerances specified herein for the original sealed FRAP stockpile. Stockpiles shall be sufficiently separated to prevent intermingling at the base. All stockpiles (including unprocessed RAP and FRAP) shall be identified by signs indicating the type as listed below (i.e. "Non- Quality, FRAP -#4 or Type 2 RAS", etc...).
- (1) Fractionated RAP (FRAP). FRAP shall consist of RAP from Class I, Superpave HMA (High and Low ESAL) or equivalent mixtures. The coarse aggregate in FRAP shall be crushed aggregate and may represent more than one aggregate type and/or quality but shall be at least C quality. All FRAP shall be processed prior to testing and sized into fractions with the separation occurring on or between the #4 (4.75 mm) and 1/2 in. (12.5 mm) sieves. Agglomerations shall be minimized such that 100 percent of the RAP in the coarse fraction shall pass the maximum sieve size specified for the mix the FRAP will be used in.

- (2) Restricted FRAP (B quality) stockpiles shall consist of RAP from Class I, Superpave (High ESAL), or HMA (High ESAL). If approved by the Engineer, the aggregate from a maximum 3.0 inch single combined pass of surface/binder milling will be classified as B quality. All millings from this application will be processed into FRAP as described previously.
- (3) Conglomerate. Conglomerate RAP stockpiles shall consist of RAP from Class I, Superpave HMA (High and Low ESAL) or equivalent mixtures. The coarse aggregate in this RAP shall be crushed aggregate and may represent more than one aggregate type and/or quality but shall be at least C quality. This RAP may have an inconsistent gradation and/or asphalt binder content prior to processing. All conglomerate RAP shall be processed (FRAP) prior to testing. Conglomerate RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (4) Conglomerate "D" Quality (DQ). Conglomerate DQ RAP stockpiles shall consist of RAP from HMA shoulders, bituminous stabilized subbases or Superpave (Low ESAL)/HMA (Low ESAL) IL-19.0L binder mixture. The coarse aggregate in this RAP may be crushed or round but shall be at least D quality. This RAP may have an inconsistent gradation and/or asphalt binder content. Conglomerate DQ RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (5) Non-Quality. RAP stockpiles that do not meet the requirements of the stockpile categories listed above shall be classified as "Non-Quality".

RAP or FRAP containing contaminants, such as earth, brick, sand, concrete, sheet asphalt, bituminous surface treatment (i.e. chip seal), pavement fabric, joint sealants, plant cleanout etc., will be unacceptable unless the contaminants are removed to the satisfaction of the Engineer. Sheet asphalt shall be stockpiled separately.

- (b) RAS Stockpiles. Type 1 and Type 2 RAS shall be stockpiled separately and shall be sufficiently separated to prevent intermingling at the base. Each stockpile shall be signed indicating what type of RAS is present. However, a RAS source may submit a written request to the Department for approval to blend mechanically a specified ratio of type 1 RAS with type 2 RAS. The source will not be permitted to change the ratio of the blend without the Department prior written approval. The Engineer's written approval will be required, to mechanically blend RAS with any fine aggregate produced under the AGCS, up to an equal weight of RAS, to improve workability. The fine aggregate shall be "B Quality" or better from an approved Aggregate Gradation Control System source. The fine aggregate shall be one that is approved for use in the HMA mixture and accounted for in the mix design and during HMA production.

Records identifying the shingle processing facility supplying the RAS, RAS type and lot number shall be maintained by project contract number and kept for a minimum of three years.

1031.03 Testing. FRAP and RAS testing shall be according to the following.

- (a) FRAP Testing. When used in HMA, the FRAP shall be sampled and tested either during processing or after stockpiling. It shall also be sampled during HMA production.
- (1) During Stockpiling. For testing during stockpiling, washed extraction samples shall be run at the minimum frequency of one sample per 500 tons (450 metric tons) for the first 2000 tons (1800 metric tons) and one sample per 2000 tons (1800 metric tons) thereafter. A minimum of five tests shall be required for stockpiles less than 4000 tons (3600 metric tons).
 - (2) Incoming Material. For testing as incoming material, washed extraction samples shall be run at a minimum frequency of one sample per 2000 tons (1800 metric tons) or once per week, whichever comes first.
 - (3) After Stockpiling. For testing after stockpiling, the Contractor shall submit a plan for approval to the District proposing a satisfactory method of sampling and testing the RAP/FRAP pile either in-situ or by restockpiling. The sampling plan shall meet the minimum frequency required above and detail the procedure used to obtain representative samples throughout the pile for testing.

Before extraction, each field sample of FRAP, shall be split to obtain two samples of test sample size. One of the two test samples from the final split shall be labeled and stored for Department use. The Contractor shall extract the other test sample according to Department procedure. The Engineer reserves the right to test any sample (split or Department-taken) to verify Contractor test results.

- (b) RAS Testing. RAS shall be sampled and tested during stockpiling according to Bureau of Materials and Physical Research Policy Memorandum, "Reclaimed Asphalt Shingle (RAS) Sources". The Contractor shall also sample as incoming material at the HMA plant.
- (1) During Stockpiling. Washed extraction and testing for unacceptable materials shall be run at the minimum frequency of one sample per 200 tons (180 metric tons) for the first 1000 tons (900 metric tons) and one sample per 1000 tons (900 metric tons) thereafter. A minimum of five samples are required for stockpiles less than 1000 tons (900 metric tons). Once a ≤ 1000 ton (900 metric ton), five-sample/test stockpile has been established it shall be sealed. Additional incoming RAS shall be in a separate working pile as designated in the Quality Control plan and only added to the sealed stockpile when the test results of the working pile are complete and are found to meet the tolerances specified herein for the original sealed RAS stockpile.

- (2) Incoming Material. For testing as incoming material at the HMA plant, washed extraction shall be run at the minimum frequency of one sample per 250 tons (227 metric tons). A minimum of five samples are required for stockpiles less than 1000 tons (900 metric tons). The incoming material test results shall meet the tolerances specified herein.

The Contractor shall obtain and make available all test results from start of the initial stockpile sampled and tested at the shingle processing facility in accordance with the facility's QC Plan.

Before extraction, each field sample shall be split to obtain two samples of test sample size. One of the two test samples from the final split shall be labeled and stored for Department use. The Contractor shall extract the other test sample according to Department procedures. The Engineer reserves the right to test any sample (split or Department-taken) to verify Contractor test results.

1031.04 Evaluation of Tests. Evaluation of tests results shall be according to the following.

- (a) Evaluation of FRAP Test Results. All test results shall be compiled to include asphalt binder content, gradation and, when applicable (for slag), G_{mm} . A five test average of results from the original pile will be used in the mix designs. Individual extraction test results run thereafter, shall be compared to the average used for the mix design, and will be accepted if within the tolerances listed below.

Parameter	FRAP
No. 4 (4.75 mm)	± 6 %
No. 8 (2.36 mm)	± 5 %
No. 30 (600 μm)	± 5 %
No. 200 (75 μm)	± 2.0 %
Asphalt Binder	± 0.3 %
G_{mm}	± 0.03 ^{1/}

- 1/ For stockpile with slag or steel slag present as determined in the current Manual of Test Procedures Appendix B 21, "Determination of Reclaimed Asphalt Pavement Aggregate Bulk Specific Gravity".

If any individual sieve and/or asphalt binder content tests are out of the above tolerances when compared to the average used for the mix design, the FRAP stockpile shall not be used in Hot-Mix Asphalt unless the FRAP representing those tests is removed from the stockpile. All test data and acceptance ranges shall be sent to the District for evaluation.

The Contractor shall maintain a representative moving average of five tests to be used for Hot-Mix Asphalt production.

With the approval of the Engineer, the ignition oven may be substituted for extractions according to the Illinois Test Procedure, "Calibration of the Ignition Oven for the Purpose of Characterizing Reclaimed Asphalt Pavement (RAP)" or Illinois Modified AASHTO T-164-11, Test Method A.

- (b) Evaluation of RAS Test Results. All of the test results, with the exception of percent unacceptable materials, shall be compiled and averaged for asphalt binder content and gradation. A five test average of results from the original pile will be used in the mix designs. Individual test results run thereafter, when compared to the average used for the mix design, will be accepted if within the tolerances listed below.

Parameter	RAS
No. 8 (2.36 mm)	± 5 %
No. 16 (1.18 mm)	± 5 %
No. 30 (600 µm)	± 4 %
No. 200 (75 µm)	± 2.5 %
Asphalt Binder Content	± 2.0 %

If any individual sieve and/or asphalt binder content tests are out of the above tolerances when compared to the average used for the mix design, the RAS shall not be used in Hot-Mix Asphalt unless the RAS representing those tests is removed from the stockpile. All test data and acceptance ranges shall be sent to the District for evaluation.

- (c) Quality Assurance by the Engineer. The Engineer may witness the sampling and splitting conduct assurance tests on split samples taken by the Contractor for quality control testing a minimum of once a month.

The overall testing frequency will be performed over the entire range of Contractor samples for asphalt binder content and gradation. The Engineer may select any or all split samples for assurance testing. The test results will be made available to the Contractor as soon as they become available.

The Engineer will notify the Contractor of observed deficiencies.

Differences between the Contractor's and the Engineer's split sample test results will be considered acceptable if within the following limits.

Test Parameter	Acceptable Limits of Precision	
	FRAP	RAS
% Passing: ^{1/}		
1 / 2 in.	5.0%	
No. 4	5.0%	
No. 8	3.0%	4.0%
No. 30	2.0%	3.0%
No. 200	2.2%	2.5%
Asphalt Binder Content	0.3%	1.0%
G _{mm}	0.030	

1/ Based on washed extraction.

In the event comparisons are outside the above acceptable limits of precision, the Engineer will immediately investigate.

- (d) Acceptance by the Engineer. Acceptable of the material will be based on the validation of the Contractor's quality control by the assurance process.

1031.05 Quality Designation of Aggregate in RAP and FRAP.

- (a) RAP. The aggregate quality of the RAP for homogenous, conglomerate, and conglomerate "D" quality stockpiles shall be set by the lowest quality of coarse aggregate in the RAP stockpile and are designated as follows.

- (1) RAP from Class I, Superpave/HMA (High ESAL), or (Low ESAL) IL-9.5L surface mixtures are designated as containing Class B quality coarse aggregate.
- (2) RAP from Superpave/HMA (Low ESAL) IL-19.0L binder mixture is designated as Class D quality coarse aggregate.
- (3) RAP from Class I, Superpave/HMA (High ESAL) binder mixtures, bituminous base course mixtures, and bituminous base course widening mixtures are designated as containing Class C quality coarse aggregate.
- (4) RAP from bituminous stabilized subbase and BAM shoulders are designated as containing Class D quality coarse aggregate.

- (b) FRAP. If the Engineer has documentation of the quality of the FRAP aggregate, the Contractor shall use the assigned quality provided by the Engineer.

If the quality is not known, the quality shall be determined as follows. Fractionated RAP stockpiles containing plus #4 (4.75 mm) sieve coarse aggregate shall have a maximum tonnage of 5,000 tons (4,500 metric tons). The Contractor shall obtain a representative sample witnessed by the Engineer. The sample shall be a minimum of 50 lb (25 kg). The sample shall be extracted according to Illinois Modified AASHTO T 164 by a consultant prequalified by the Department for the specified testing. The consultant shall submit the test results along with the recovered aggregate to the District Office. The cost for this testing shall be paid by the Contractor. The District will forward the sample to the BMPR Aggregate Lab for MicroDeval Testing, according to Illinois Modified AASHTO T 327. A maximum loss of 15.0 percent will be applied for all HMA applications. The fine aggregate portion of the fractionated RAP shall not be used in any HMA mixtures that require a minimum of "B" quality aggregate or better, until the coarse aggregate fraction has been determined to be acceptable thru a MicroDeval Testing.

1031.06 Use of FRAP and/or RAS in HMA. The use of FRAP and/or RAS shall be a Contractor's option when constructing HMA in all contracts.

(a) FRAP. The use of FRAP in HMA shall be as follows.

- (1) Coarse Aggregate Size (after extraction). The coarse aggregate in all FRAP shall be equal to or less than the nominal maximum size requirement for the HMA mixture to be produced.
- (2) Steel Slag Stockpiles. FRAP stockpiles containing steel slag or other expansive material, as determined by the Department, shall be homogeneous and will be approved for use in HMA (High ESAL and Low ESAL) mixtures regardless of lift or mix type.
- (3) Use in HMA Surface Mixtures (High and Low ESAL). FRAP stockpiles for use in HMA surface mixtures (High and Low ESAL) shall have coarse aggregate that is Class B quality or better. FRAP shall be considered equivalent to limestone for frictional considerations unless produced/screened to minus 3/8 inch.
- (4) Use in HMA Binder Mixtures (High and Low ESAL), HMA Base Course, and HMA Base Course Widening. FRAP stockpiles for use in HMA binder mixtures (High and Low ESAL), HMA base course, and HMA base course widening shall be FRAP in which the coarse aggregate is Class C quality or better.
- (5) Use in Shoulders and Subbase. FRAP stockpiles for use in HMA shoulders and stabilized subbase (HMA) shall be FRAP, Restricted FRAP, conglomerate, or conglomerate DQ.

(b) RAS. RAS meeting Type 1 or Type 2 requirements will be permitted in all HMA applications as specified herein.

- (c) FRAP and/or RAS Usage Limits. Type 1 or Type 2 RAS may be used alone or in conjunction with FRAP in HMA mixtures up to a maximum of 5.0% by weight of the total mix.

When FRAP, RAS or FRAP in conjunction with RAS is used, the percent of virgin asphalt binder replacement (ABR) shall not exceed the amounts indicated in the table below for a given N Design.

Max Asphalt Binder Replacement for FRAP with RAS Combination

HMA Mixtures ^{1/ 2/ 4/}	Maximum % ABR		
	Binder/Leveling Binder	Surface	Polymer Modified ^{3/}
Ndesign			
30L	50	40	30
50	40	35	30
70	40	30	30
90	40	30	30
4.75 mm N-50			40
SMA N-80			30

- 1/ For HMA "All Other" (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.
- 2/ When the binder replacement exceeds 15 percent for all mixes, except for SMA and IL-4.75, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement using a virgin asphalt binder grade of PG64-22 will be reduced to a PG58-28). When constructing full depth HMA and the ABR is less than 15 percent, the required virgin asphalt binder grade shall be PG64-28.
- 3/ When the ABR for SMA or IL-4.75 is 15 percent or less, the required virgin asphalt binder shall be SBS PG76-22 and the elastic recovery shall be a minimum of 80. When the ABR for SMA or IL-4.75 exceeds 15%, the virgin asphalt binder grade shall be SBS PG70-28 and the elastic recovery shall be a minimum of 80.
- 4/ When FRAP or RAS is used alone, the maximum percent asphalt binder replacement designated on the table shall be reduced by 10%.

1031.07 HMA Mix Designs. At the Contractor's option, HMA mixtures may be constructed utilizing RAP/FRAP and/or RAS material meeting the detailed requirements specified herein.

- (a) FRAP and/or RAS. FRAP and /or RAS mix designs shall be submitted for verification. If additional FRAP or RAS stockpiles are tested and found to be within tolerance, as defined under "Evaluation of Tests" herein, and meet all requirements herein, the additional FRAP or RAS stockpiles may be used in the original design at the percent previously verified.
- (b) RAS. Type 1 and Type 2 RAS are not interchangeable in a mix design. A RAS stone bulk specific gravity (Gsb) of 2.500 shall be used for mix design purposes.

1031.08 HMA Production. HMA production utilizing FRAP and/or RAS shall be as follows.

To remove or reduce agglomerated material, a scalping screen, gator, crushing unit, or comparable sizing device approved by the Engineer shall be used in the RAS and FRAP feed system to remove or reduce oversized material. If material passing the sizing device adversely affects the mix production or quality of the mix, the sizing device shall be set at a size specified by the Engineer.

If during mix production, corrective actions fail to maintain FRAP, RAS or QC/QA test results within control tolerances or the requirements listed herein the Contractor shall cease production of the mixture containing FRAP or RAS and conduct an investigation that may require a new mix design.

- (a) RAS. RAS shall be incorporated into the HMA mixture either by a separate weight depletion system or by using the RAP weigh belt. Either feed system shall be interlocked with the aggregate feed or weigh system to maintain correct proportions for all rates of production and batch sizes. The portion of RAS shall be controlled accurately to within ± 0.5 percent of the amount of RAS utilized. When using the weight depletion system, flow indicators or sensing devices shall be provided and interlocked with the plant controls such that the mixture production is halted when RAS flow is interrupted.
- (b) HMA Plant Requirements. HMA plants utilizing FRAP and/or RAS shall be capable of automatically recording and printing the following information.

(1) Dryer Drum Plants.

- a. Date, month, year, and time to the nearest minute for each print.
- b. HMA mix number assigned by the Department.
- c. Accumulated weight of dry aggregate (combined or individual) in tons (metric tons) to the nearest 0.1 ton (0.1 metric ton).

- d. Accumulated dry weight of RAS and FRAP in tons (metric tons) to the nearest 0.1 ton (0.1 metric ton).
 - e. Accumulated mineral filler in revolutions, tons (metric tons), etc. to the nearest 0.1 unit.
 - f. Accumulated asphalt binder in gallons (liters), tons (metric tons), etc. to the nearest 0.1 unit.
 - g. Residual asphalt binder in the RAS and FRAP material as a percent of the total mix to the nearest 0.1 percent.
 - h. Aggregate RAS and FRAP moisture compensators in percent as set on the control panel. (Required when accumulated or individual aggregate and RAS and FRAP are printed in wet condition.)
 - i. When producing mixtures with FRAP and/or RAS, a positive dust control system shall be utilized.
 - j. Accumulated mixture tonnage.
 - k. Dust Removed (accumulated to the nearest 0.1 ton)
- (2) Batch Plants.
- a. Date, month, year, and time to the nearest minute for each print.
 - b. HMA mix number assigned by the Department.
 - c. Individual virgin aggregate hot bin batch weights to the nearest pound (kilogram).
 - d. Mineral filler weight to the nearest pound (kilogram).
 - f. RAS and FRAP weight to the nearest pound (kilogram).
 - g. Virgin asphalt binder weight to the nearest pound (kilogram).
 - h. Residual asphalt binder in the RAS and FRAP material as a percent of the total mix to the nearest 0.1 percent.

The printouts shall be maintained in a file at the plant for a minimum of one year or as directed by the Engineer and shall be made available upon request. The printing system will be inspected by the Engineer prior to production and verified at the beginning of each construction season thereafter.

1031.09 RAP in Aggregate Surface Course and Aggregate Shoulders. The use of RAP or FRAP in aggregate surface course and aggregate shoulders shall be as follows.

- (a) Stockpiles and Testing. RAP stockpiles may be any of those listed in Article 1031.02, except “Non-Quality” and “FRAP”. The testing requirements of Article 1031.03 shall not apply. RAP used to construct aggregate surface course and aggregate shoulders shall be according to the current Bureau of Materials and Physical Research’s Policy Memorandum, “Reclaimed Asphalt Pavement (RAP) for Aggregate Applications”
- (b) Gradation. One hundred percent of the RAP material shall pass the 1 1/2 in. (37.5mm) sieve. The RAP material shall be reasonably well graded from coarse to fine. RAP material that is gap-graded, FRAP, or single sized will not be accepted for use as Aggregate Surface Course and Aggregate Shoulders.”

GENERAL ELECTRICAL REQUIREMENTS

Effective: January 1, 2012

Add the following to Article 801 of the Standard Specifications:

“Maintenance transfer and Preconstruction Inspection:

General. Before performing any excavation, removal, or installation work (electrical or otherwise) at the site, the Contractor shall request a maintenance transfer and preconstruction site inspection, to be held in the presence of the Engineer and a representative of the party or parties responsible for maintenance of any lighting and/or traffic control systems which may be affected by the work. The request for the maintenance transfer and preconstruction inspection shall be made no less than seven (7) calendar days prior to the desired inspection date. The maintenance transfer and preconstruction inspection shall:

Establish the procedures for formal transfer of maintenance responsibility required for the construction period.

Establish the approximate location and operating condition of lighting and/or traffic control systems which may be affected by the work

Marking of Existing Cable Systems. The party responsible for maintenance of any existing lighting and/or traffic control systems at the project site will, at the Contractor's request, mark and/or stake, once per location, all underground cable routes owned or maintained by the State. A project may involve multiple "locations" where separated electrical systems are involved (i.e. different controllers). The markings shall be taken to have a horizontal tolerance of at least 304.8 mm (one (1) foot) to either side.. The request for the cable locations and marking shall be made at the same time the request for the maintenance transfer and preconstruction inspection is made. The Contractor shall exercise extreme caution where existing buried cable runs are involved. The markings of existing systems are made strictly for assistance to the Contractor and this does not relieve the Contractor of responsibility for the repair or replacement of any cable run damaged in the course of his work, as specified elsewhere herein. Note that the contractor shall be entitled to only one request for location marking of existing systems and that multiple requests may only be honored at the contractor's expense. No locates will be made after maintenance is transferred, unless it is at the contractor's expense.

Condition of Existing Systems. The Contractor shall conduct an inventory of all existing electrical system equipment within the project limits, which may be affected by the work, making note of any parts which are found broken or missing, defective or malfunctioning. Megger and load readings shall be taken for all existing circuits which will remain in place or be modified. If a circuit is to be taken out in its entirety, then readings do not have to be taken. The inventory and test data shall be reviewed with and approved by the Engineer and a record of the inventory shall be submitted to the Engineer for the record. Without such a record, all systems transferred to the Contractor for maintenance during construction shall be returned at the end of construction in complete, fully operating condition."

Add the following to the 1st paragraph of Article 801.05(a) of the Standard Specifications:

"Items from multiple disciplines shall not be combined on a single submittal and transmittal. Items for lighting, signals, surveillance and CCTV must be in separate submittals since they may be reviewed by various personnel in various locations."

Revise the second sentence of the 5th paragraph of Article 801.05(a) of the Standard Specifications to read:

"The Engineer will stamp the submittals indicating their status as 'Approved', 'Approved as Noted', 'Disapproved', or 'Information Only'.

Revise the 6th paragraph of Article 801.05(a) of the Standard Specifications to read:

“Resubmittals. All submitted items reviewed and marked ‘Approved as Noted’, or ‘Disapproved’ are to be resubmitted in their entirety with a disposition of previous comments to verify contract compliance at no additional cost to the state unless otherwise indicated within the submittal comments.”

Revise Article 801.11(a) of the Standard Specifications to read:

“Lighting Operation and Maintenance Responsibility. The scope of work shall include the assumption of responsibility for the continuing operation and maintenance the of existing, proposed, temporary, sign and navigation lighting, or other lighting systems and all appurtenances affected by the work as specified elsewhere herein. Maintenance of lighting systems is specified elsewhere and will be paid for separately

Energy and Demand Charges. The payment of basic energy and demand charges by the electric utility for existing lighting which remains in service will continue as a responsibility of the Owner, unless otherwise indicated. Unless otherwise indicated or required by the Engineer duplicate lighting systems (such as temporary lighting and proposed new lighting) shall not be operated simultaneously at the Owner's expense and lighting systems shall not be kept in operation during long daytime periods at the Owner's expense. Upon written authorization from the Engineer to place a proposed new lighting system in service, whether the system has passed final acceptance or not, (such as to allow temporary lighting to be removed), the Owner will accept responsibility for energy and demand charges for such lighting, effective the date of authorization. All other energy and demand payments to the utility shall be the responsibility of the Contractor until final acceptance.”

Add the following to Section 801 of the Standard Specifications:

“Lighting Cable Identification. Each wire installed shall be identified with its complete circuit number at each termination, splice, junction box or other location where the wire is accessible.”

“Lighting Cable Fuse Installation. Standard fuse holders shall be used on non-frangible (non-breakaway) light pole installations and quick-disconnect fuse holders shall be used on frangible (breakaway) light pole installations. Wires shall be carefully stripped only as far as needed for connection to the device. Over-stripping shall be avoided. An oxide inhibiting lubricant shall be applied to the wire for minimum connection resistance before the terminals are crimped-on. Crimping shall be performed in accordance with the fuse holder manufacturer’s recommendations. The exposed metal connecting portion of the assembly shall be taped with two half-lapped wraps of electrical tape and then covered by the specified insulating boot. The fuse holder shall be installed such that the fuse side is connected to the pole wire (load side) and the receptacle side of the holder is connected to the line side.”

Revise the 2nd paragraph of Article 801.16 of the Standard Specifications to read:

“When the work is complete, and seven days before the request for a final inspection, the full-size set of contract drawings. Stamped “RECORD DRAWINGS”, shall be submitted to the Engineer for review and approval and shall be stamped with the date and the signature of the Contractor’s supervising Engineer or electrician. The record drawings shall be submitted in PDF format on CDROM as well as hardcopy for review and approval. In addition to the record drawings, copies of the final catalog cuts which have been Approved or Approved as Noted shall be submitted in PDF format along with the record drawings. The PDF files shall clearly indicate either by filename or PDF table of contents the respective pay item number. Specific part or model numbers of items which have been selected shall be clearly visible.”

Add the following to Article 801.16 of the Standard Specifications:

“In addition to the specified record drawings, the Contactor shall record GPS coordinates of the following electrical components being installed, modified or being affected in other ways by this contract:

- Last light pole on each circuit
- Handholes
- Conduit roadway crossings
- Controllers
- Control Buildings
- Structures with electrical connections, i.e. DMS, lighted signs.
- Electric Service locations
- CCTV Camera installations
- Fiber Optic Splice Locations

Datum to be used shall be North American 1983.

Data shall be provided electronically and in print form. The electronic format shall be compatible with MS Excel. Latitude and Longitude shall be in decimal degrees with a minimum of 6 decimal places. Each coordinate shall have the following information:

1. Description of item
2. Designation or approximate station if the item is undesignated
3. Latitude
4. Longitude

Examples:

Equipment Description	Equipment Designation	Latitude	Longitude
CCTV Camera pole	ST42	41.580493	-87.793378
FO mainline splice handhole	HHL-ST31	41.558532	-87.792571
Handhole	HH at STA 234+35	41.765532	-87.543571
Electric Service	Elec Srv	41.602248	-87.794053
Conduit crossing	SB IL83 to EB I290 ramp SIDE A	41.584593	-87.793378
Conduit crossing	SB IL83 to EB I290 ramp SIDE B	41.584600	-87.793432
Light Pole	DA03	41.558532	-87.792571
Lighting Controller	X	41.651848	-87.762053
Sign Structure	FGD	41.580493	-87.793378
Video Collection Point	VCP-IK	41.558532	-87.789771
Fiber splice connection	Toll Plaza34	41.606928	-87.794053

Prior to the collection of data, the contractor shall provide a sample data collection of at least six data points of known locations to be reviewed and verified by the Engineer to be accurate within 100 feet. Upon verification, data collection can begin. Data collection can be made as construction progresses, or can be collected after all items are installed. If the data is unacceptable the contractor shall make corrections to the data collection equipment and or process and submit the data for review and approval as specified.

Accuracy. Data collected is to be mapping grade. A handheld mapping grade GPS device shall be used for the data collection. The receiver shall support differential correction and data shall have a minimum 5 meter accuracy after post processing.

GPS receivers integrated into cellular communication devices, recreational and automotive GPS devices are not acceptable.

The GPS shall be the product of an established major GPS manufacturer having been in the business for a minimum of 6 years.”

LUMINAIRE

Effective: January 1, 2012

Add the following to first paragraph of Article 1067(c) of the Standard Specifications:

“The reflector shall not be altered by paint or other opaque coatings which would cover or coat the reflecting surface. Control of the light distribution by any method other than the reflecting material and the aforementioned clear protective coating that will alter the reflective properties of the reflecting surface is unacceptable”

Add the following to Article 1067(f) of the Standard Specifications:

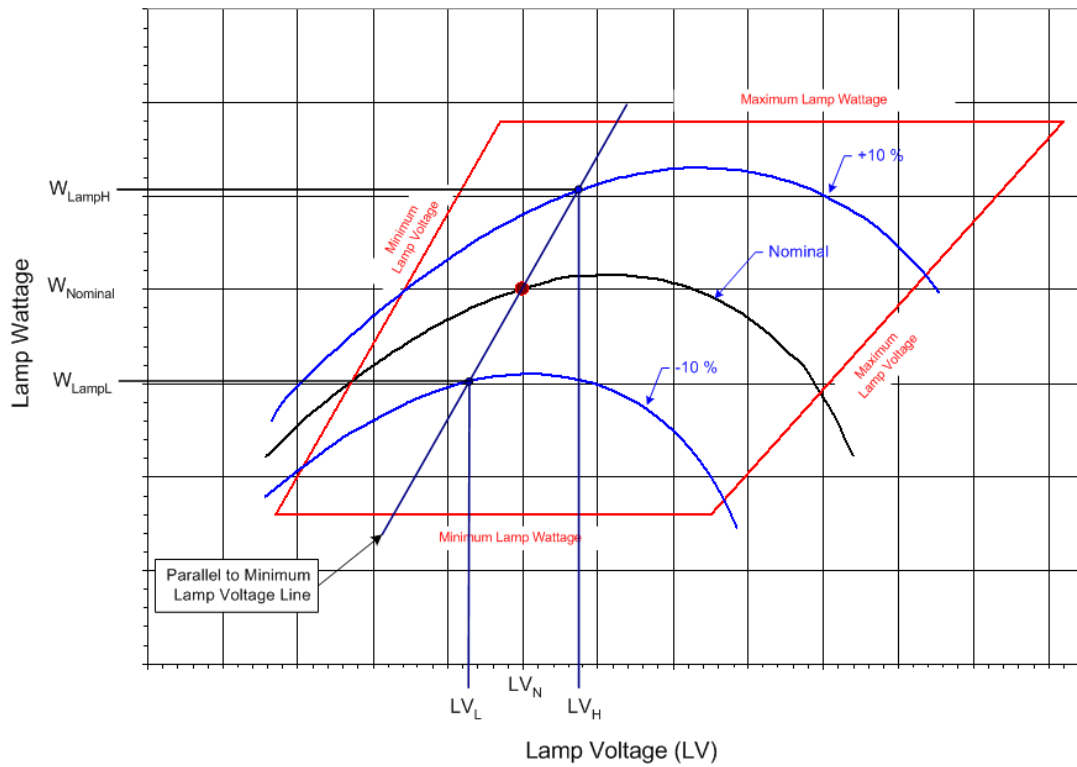
“The ballast shall be a High Pressure Sodium, high power factor, constant wattage auto-regulator, lead type (CWA) for operation on a nominal 240 volt system.”

Revise Article 1067(f)(1) of the Standard Specifications to read:

“The high pressure sodium, auto-regulator, lead type (CWA) ballast shall be designed to ANSI Standards and shall be designed and rated for operation on a nominal 240 volt system. The ballast shall provide positive lamp ignition at the input voltage of 216 volts. It shall operate the lamp over a range of input voltages from 216 to 264 volts without damage to the ballast. It shall provide lamp operation within lamp specifications for rated lamp life at input design voltage range. Operating characteristics shall produce output regulation not exceeding the following values:

Nominal Ballast Wattage	Maximum Ballast Regulation
750	25%
400	26%
310	26%
250	26%
150	24%
70	18%

For this measure, regulation shall be defined as the ratio of the lamp watt difference between the upper and lower operating curves to the nominal lamp watts; with the lamp watt difference taken within the ANSI trapezoid at the nominal lamp operating voltage point parallel to the minimum lamp volt line:



$$\text{Ballast Regulation} = \frac{W_{LampH} - W_{LampL}}{W_{LampN}} \times 100$$

where:

W_{LampH} = lamp watts at +10% line voltage when Lamp voltage = LV_H

W_{LampL} = lamp watts at - 10% line voltage when lamp voltage = LV_L

W_{lampN} = lamp watts at nominal lamp operating voltage = LV_N

Wattage	Nominal Lamp Voltage, LV _N	LV _L	LV _H
750	120v	115v	125v
400	100v	95v	105v
310	100v	95v	105v
250	100v	95v	105v
150	55v	50v	60v
70	52v	47v	57v

Ballast losses, based on cold bench tests, shall not exceed the following values:

Nominal Ballast Wattage	Maximum Ballast Losses
750	15%
400	20%
310	21%
250	24%
150	26%
70	34%

Ballast losses shall be calculated based on input watts and lamp watts at nominal system voltage as indicated in the following equation:

$$\text{Ballast Losses} = \frac{W_{Line} - W_{Lamp}}{W_{Lamp}} \times 100$$

where:

W_{line} = line watts at nominal system voltage

W_{lamp} = lamp watts at nominal system voltage

Ballast output to lamp. At nominal system voltage and nominal lamp voltage, the ballast shall deliver lamp wattage with the variation specified in the following table.

Nominal Ballast Wattage	Output to lamp variation
750	± 7.5%
400	± 7.5%
310	± 7.5%
250	± 7.5%
150	± 7.5%
70	± 7.5%

Example: For a 400w luminaire, the ballast shall deliver 400 watts ±7.5% at a lamp voltage of 100v for the nominal system voltage of 240v which is the range of 370w to 430w.

Ballast output over lamp life. Over the life of the lamp the ballast shall produce average output wattage of the nominal lamp rating as specified in the following table. Lamp wattage readings shall be taken at 5-volt increments throughout the ballast trapezoid. Reading shall begin at the lamp voltage (L_v) specified in the table and continue at 5 volt increments until the right side of the trapezoid is reached. The lamp wattage values shall then be averaged and shall be within the specified value of the nominal ballast rating. Submittal documents shall include a tabulation of the lamp wattage vs. lamp voltage readings.

Nominal Ballast Wattage	LV Readings begin at	Maximum Wattage Variation
750	110v	± 7.5%
400	90v	± 7.5%
310	90v	± 7.5%
250	90v	± 7.5%
150	50v	± 7.5%
70	45v	± 7.5%

Example: For a 400w luminaire, the averaged lamp wattage reading shall not exceed the range of ±7.5% which is 370w to 430w”

Add the following to Article 1067(h) of the Standard Specifications:

“Independent Testing. Independent testing of luminaires shall be required whenever the pay item quantity of luminaires of a given pay item, as indicated on the plans, is 50 or more. For each luminaire type to be so tested, one luminaire plus one luminaire for each 50 luminaires shall be tested. Example: A plan pay item quantity of 75 luminaires for a specific pay item would dictate that 2 be tested; 135 luminaires would dictate that three be tested.” If the luminaire performance table is missing from the contract documents, the luminaire(s) shall be tested and the test results shall be evaluated against the manufacturer’s data as provided in the approved material submittal. The test luminaire(s) results shall be equal to or better than the published data. If the test results indicated performance not meeting the published data, the test luminaire will be designated as failed and corrective action as described herein shall be performed.

The Contractor shall be responsible for all costs associated with the specified testing, including but not limited to shipping, travel and lodging costs as well as the costs of the tests themselves, all as part of the bid unit price for this item. Travel, lodging and other associated costs for travel by the Engineer shall be direct-billed to or shall be pre-paid by the Contractor, requiring no direct reimbursement to the Engineer or the independent witness, as applicable”

The Contractor shall select one of the following options for the required testing with the Engineer’s approval:

- a. Engineer Factory Selection for Independent Lab: The Contractor may select this option if the luminaire manufacturing facility is within the state of Illinois. The Contractor shall propose an independent test laboratory for approval by the Engineer. The selected luminaires shall be marked by the Engineer and shipped to the independent laboratory for tests.
- b. Engineer Witness of Independent Lab Test: The Contractor may select this option if the independent testing laboratory is within the state of Illinois. The Engineer shall select, from the project luminaires at the manufacturer’s facility or at the Contractor’s storage facility, luminaires for testing by the independent laboratory.

- c. Independent Witness of Manufacturer Testing: The independent witness shall select from the project luminaires at the manufacturers facility or at the Contractor's storage facility, the luminaires for testing. The Contractor shall propose a qualified independent agent, familiar with the luminaire requirements and test procedures, for approval by the Engineer, to witness the required tests as performed by the luminaire manufacturer.

The independent witness shall as a minimum meet the following requirements:

- ▶ Have been involved with roadway lighting design for at least 15 years.
- ▶ Not have been the employee of a luminaire or ballast manufacturer within the last 5 years.
- ▶ Not associated in any way (plan preparation, construction or supply) with the particular project being tested.
- ▶ Be a member of IESNA in good standing.
- ▶ Provide a list of professional references.

This list is not an all inclusive list and the Engineer will make the final determination as to the acceptability of the proposed independent witness.

- d. Engineer Factory Selection and Witness of Manufacturer Testing: The Contractor may select this option if the luminaire manufacturing facility is within the state of Illinois. At the Manufacturer's facility, the Engineer shall select the luminaires to be tested and shall be present during the testing process. The Contractor shall schedule travel by the Engineer to and from the Manufacturer's laboratory to witness the performance of the required tests.

Should any of the tested luminaires fail to satisfy the specifications and perform according to approved submittal information, the luminaire shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance. In the case of corrections, the Contractor shall advise the Engineer of corrections made and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated. The number of luminaires to be tested shall be the same quantity as originally tested; i.e. if three luminaires were tested originally, one, two or three failed, another three must be tested after corrective action is taken.

Revise Article 1067.06(a)(1) of the Standard Specifications to read:

"The lamps shall be of the clear type and shall have a color of 1900° to 2200° Kelvin."

Add the following table(s) to Article 1067 of the Standard Specifications:

IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	50 (ft)
	Number of Lanes	4
	I.E.S. Surface Classification	R3
	Q-Zero Value	.07
LIGHT POLE DATA	Mounting Height	21 (ft)
	Mast Arm Length	8 (ft)
	Pole Set-Back From Edge of Pavement	0 (ft)
LUMINAIRE DATA	Lamp Type	HPS
	Lamp Lumens	16000
	I.E.S. Vertical Distribution	Medium
	I.E.S. Control Of Distribution	Cutoff
	I.E.S. Lateral Distribution	Type 3
	Total Light Loss Factor	0.70
LAYOUT DATA	Spacing	128 (ft)
	Configuration	Opposite
	Luminaire Overhang over edge of pavement	8 (ft)

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS		
--------------------------	--	--

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

LUMINANCE	Average Luminance, L_{AVE}	1.3 Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	3:1 (Max)
	Uniformity Ratio, L_{MAX}/L_{MIN}	5:1 (Max)
	Veiling Luminance Ratio, L_V/L_{AVE}	0.3:1 (Max)

UNDERGROUND RACEWAYS

Effective: January 1, 2012

Revise Article 810.04 of the Standard Specifications to read:

“Installation. All underground conduit shall have a minimum depth of 30-inches (700 mm) below the finished grade.”

Add the following to Article 810.04 of the Standard Specifications:

“All metal conduit installed underground shall be Rigid Steel Conduit unless otherwise indicated on the plans.”

Add the following to Article 810.04 of the Standard Specifications:

“All raceways which extend outside of a structure or duct bank but are not terminated in a cabinet, junction box, pull box, handhole, post, pole, or pedestal shall extend a minimum of 300 mm (12”) or the length shown on the plans beyond the structure or duct bank. The end of this extension shall be capped and sealed with a cap designed for the conduit to be capped. The ends of rigid metal conduit to be capped shall be threaded, the threads protected with full galvanizing, and capped with a threaded galvanized steel cap. The ends of rigid nonmetallic conduit and coilable nonmetallic conduit shall be capped with a rigid PVC cap of not less than 3 mm (0.125”) thick. The cap shall be sealed to the conduit using a room-temperature-vulcanizing (RTV) sealant compatible with the material of both the cap and the conduit. A washer or similar metal ring shall be glued to the inside center of the cap with epoxy, and the pull cord shall be tied to this ring.”

Add the following to Article 810.04(c) of the Standard Specifications:

“Coilable non-metallic conduit shall be machine straightened to remove the longitudinal curvature caused by coiling the conduit onto reels prior to installing in trench, encasing in concrete or embedding in structure. The straightening shall not deform the cross-section of the conduit such that any two measured outside diameters, each from any location and at any orientation around the longitudinal axis along the conduit differ by more than 6 mm (0.25”).” The longitudinal axis of the straightened conduit shall not deviate by more than 20 mm per meter (0.25” per foot” from a straight line. The HDPE and straightening mechanism manufacturer operating temperatures shall be followed.

UNIT DUCT

Effective: January 1, 2012

Revise the first paragraph of Article 810.04 to read:

“The unit duct shall be installed at a minimum depth of 30-inches (760 mm) unless otherwise directed by the Engineer.”

Revise Article 1088.01(c) to read:

“(c) Coilable Nonmetallic Conduit.

General:

The duct shall be a plastic duct which is intended for underground use and which can be manufactured and coiled or reeled in continuous transportable lengths and uncoiled for further processing and/or installation without adversely affecting its properties of performance. The duct shall be a plastic duct which is intended for underground use and can be manufactured and coiled or reeled in continuous transportable lengths and uncoiled for further processing and/or installation without adversely affecting its properties of performance.

The duct shall be made of high density polyethylene which shall meet the requirements of ASTM D 2447, for schedule 40. The duct shall be composed of black high density polyethylene meeting the requirements of ASTM D 3350, Class C, Grade P33. The wall thickness shall be in accordance with Table 2 for ASTM D 2447.

The duct shall be UL Listed per 651-B for continuous length HDPE coiled conduit. The duct shall also comply with NEC Article 354.100 and 354.120.

Submittal information shall demonstrate compliance with the details of these requirements.

Dimensions:

Duct dimensions shall conform to the standards listed in ASTM D2447. Submittal information shall demonstrate compliance with these requirements.

Nominal Size		Nominal I.D.		Nominal O.D.		Minimum Wall	
mm	in	mm	in	mm	in	mm	in
31.75	1.25	35.05	1.380	42.16	1.660	3.556 +0.51	0.140 +0.020
38.1	1.50	40.89	1.610	48.26	1.900	3.683 +0.51	0.145 +0.020

Nominal Size		Pulled Tensile	
mm	in	N	lbs
31.75	1.25	3322	747
38.1	1.50	3972	893

Marking:

As specified in NEMA Standard Publication No. TC-7, the duct shall be clearly and durably marked at least every 3.05 meters (10 feet) with the material designation (HDPE for high density polyethylene), nominal size of the duct and the name and/or trademark of the manufacturer.

Performance Tests:

Polyethylene Duct testing procedures and test results shall meet the requirements of UL 651. Certified copies of the test report shall be submitted to the Engineer prior to the installation of the duct. Duct crush test results shall meet or exceed the following requirements:

Duct Diameter		Min. force required to deform sample 50%	
mm	in	N	lbs
35	1.25	4937	1110
41	1.5	4559	1025

WIRE AND CABLE

Effective: January 1, 2012

Add the following to the first paragraph of Article 1066.02(a):

“The cable shall be rated at a minimum of 90°C dry and 75°C wet and shall be suitable for installation in wet and dry locations, and shall be resistant to oils and chemicals.”

Revise the Aerial Electric Cable Properties table of Article 1066.03(a)(3) to read:

Aerial Electric Cable Properties

Phase Conductor		Messenger wire			
Size AWG	Stranding	Average Insulation Thickness		Minimum Size AWG	Stranding
		mm	mils		
6	7	1.1	(45)	6	6/1
4	7	1.1	(45)	4	6/1
2	7	1.1	(45)	2	6/1
1/0	19	1.5	(60)	1/0	6/1
2/0	19	1.5	(60)	2/0	6/1
3/0	19	1.5	(60)	3/0	6/1
4/0	19	1.5	(60)	4/0	6/1

Add the following to Article 1066.03(b) of the Standard Specifications:

“Cable sized No. 2 AWG and smaller shall be U.L. listed Type RHH/RHW and may be Type RHH/RHW/USE. Cable sized larger than No. 2 AWG shall be U.L. listed Type RHH/RHW/USE.”

Revise Article 1066.04 to read:

“Aerial Cable Assembly. The aerial cable shall be an assembly of insulated aluminum conductors according to Section 1066.02 and 1066.03. Unless otherwise indicated, the cable assembly shall be composed of three insulated conductors and a steel reinforced bare aluminum conductor (ACSR) to be used as the ground conductor. Unless otherwise indicated, the code word designation of this cable assembly is “Palomino”. The steel reinforced aluminum conductor shall conform to ASTM B-232. The cable shall be assembled according to ANSI/ICEA S-76-474.”

Revise the second paragraph of Article 1066.05 to read:

“The tape shall have reinforced metallic detection capabilities consisting of a woven reinforced polyethylene tape with a metallic core or backing.”

KEEPING THE EXPRESSWAY OPEN TO TRAFFIC

Effective: March 22, 1996

Revised: June 17, 2013

Whenever work is in progress on or adjacent to an expressway, the Contractor shall provide the necessary traffic control devices to warn the public and to delineate the work zone as required in these Special Provisions, the Standard Specifications, the State Standards and the District Freeway details. All Contractors' personnel shall be limited to these barricaded work zones and shall not cross the expressway.

The Contractor shall request and gain approval from the Illinois Department of Transportation's Expressway Traffic Operations Engineer (847-705-4151) twenty-four (24) hours in advance of all daily lane, ramp and shoulder closures and seventy-two (72) hours in advance of all permanent and weekend closures on all Freeways and/or Expressways in District One. This advance notification is calculated based on workweek of Monday through Friday and shall not include weekends or Holidays.

LOCATION: I-290: @ Peoria St. Prior to Stage Construction

WEEK NIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
Sunday - Thursday	1-Lane	8:00 PM	to	5:00 AM
	2-Lane	11:00 PM	to	5:00 AM
	3-Left Lane*	1:00 AM	to	5:00 AM
Friday	1-Lane	10:00 PM (Fri)	to	8:00 AM (Sat)
	2-Lane	11:59 PM (Fri)	to	6:00 AM (Sat)
	3-Left Lane*	NOT		ALLOWED
Saturday	1-Lane	10:00 PM (Sat)	to	10:00 AM (Sun)
	2-Lane	11:59 PM (Sat)	to	8:00 AM (Sun)
	3-Left Lane*	1:00 AM (Sun)	to	7:00 AM (Sun)

LOCATION: I-290: @ Peoria St. During Stage Construction

WEEK NIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
Sunday - Thursday	1-Lane	11:00 PM	to	5:00 AM
	2-Left Lane*	1:00 AM	to	5:00 AM
Friday	2-Lane	11:59 PM (Fri)	to	6:00 AM (Sat)
	3-Left Lane*	NOT		ALLOWED
Saturday	2-Lane	11:59 PM (Sat)	to	8:00 AM (Sun)
	3-Left Lane*	1:00 AM (Sun)	to	7:00 AM (Sun)

* 3 lane closures will only be allowed from the left & are only approved for specific operations.

In addition to the hours noted above, temporary shoulder and partial ramp closures are allowed weekdays between 9:00 A.M. and 3:00 P.M. and between 7:00 P.M. and 5:00 A.M.

Narrow lanes and permanent shoulder closures will not be allowed between Dec. 1st and April 1st.

Full Expressway Closures will only be permitted for a maximum of 15 minutes at a time during the low traffic volume hours of 1:00 A.M. to 5:00 A.M. Monday thru Friday and from 1:00 A.M. to 7:00 A.M. on Sunday. During Full Expressway Closures, the Contractor will be required to close off all lanes except one, using Freeway Standard Closures. Police forces should be notified and requested to close off the remaining lane at which time the work item may be removed or set in place. The District One Traffic Operations Department **shall be** notified (847-705-4151) at least 3 working days (weekends and holidays DO NOT count into this 72 hours notification) in advance of the proposed road closure and will coordinate the closure operations with police forces.

All stage changes requiring the stopping and/or the pacing of traffic shall take place during the allowable hours for Full Expressway Closures and shall be approved by the Department.

Temporary ramp closures for service interchanges will only be permitted at night during the restricted hours listed for temporary one-lane closures within the project limits. However, no two (2) adjacent entrance and exit ramps in one direction of the expressway shall be closed at the same time.

Freeway to freeway (system interchange) full ramp closures for two lane ramps will not be permitted. Partial ramp closures of system ramps may be allowed during the 1-lane closure hours above. System ramp full closures for single lane ramps are only permitted for a maximum of four (4) hours

- between the hours of 1:00 a.m. and 5:00 a.m. on Monday thru Friday
- between the hours of 1:00 a.m. and 6:00 a.m. on Saturday, and
- between the hours of 1:00 a.m. and 7:00 a.m. on Sunday.

The Contractor shall furnish and install large (48" X 48") "DETOUR with arrow" signs as directed by the Engineer for all system ramp closures. In addition, one portable changeable message sign will be required to be placed in advance of the ramp closure. The cost of these signs and PCMS board shall be included in the cost of traffic control and protection (6 static signs maximum per closure).

Should the Contractor fail to completely open, and keep open, the ramps to traffic in accordance with the above limitations, the Contractor shall be liable to the Department for liquidated damages as noted under the Special Provision, "Failure to Open Traffic Lanes to Traffic".

All daily lane closures shall be removed during adverse weather conditions such as rain, snow, and/or fog and as determined by the Engineer.

Additional lane closure hour restrictions may have to be imposed to facilitate the flow of traffic to and from major sporting events and/or other events.

All lane closure signs shall not be erected any earlier than one-half (1/2) hour before the starting hours listed above. Also, these signs should be taken down within one-half (1/2) hour after the closure is removed.

The Contractor will be required to cooperate with all other contractors when erecting lane closures on the expressway. All lane closures (includes the taper lengths) without a three (3) mile gap between each other, in one direction of the expressway, shall be on the same side of the pavement. Lane closures on the same side of the pavement with a half (1/2) mile or less gap between the end of one work zone and the start of taper of next work zone should be connected. The maximum length of any lane closure on the project and combined with any adjacent projects shall be three (3) miles. Gaps between successive permanent lane closures shall be no less than two (2) miles in length.

Private vehicles shall not be parked in the work zone. Contractor's equipment and/or vehicles shall not be parked on the shoulders or in the median during non-working hours. The parking of equipment and/or vehicles on State right-of-way will only be permitted at the locations approved by the Engineer.

FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC

Effective: March 22, 1996

Revised: February 9, 2005

Should the Contractor fail to completely open and keep open all the traffic lanes to traffic in accordance with the limitations specified under the Special Provisions for "Keeping the Expressway Open to Traffic", the Contractor shall be liable to the Department for the amount of:

I-290 and Ramps: All Stages
One lane or ramp blocked = \$1,700 /15 min.
Two lanes blocked = \$3,500 /15 min.

Not as a penalty but as liquidated and ascertained damages for each and every 15 minute interval or a portion thereof that a lane is blocked outside the allowable time limitations. Such damages may be deducted by the Department from any monies due the Contractor. These damages shall apply during the contract time and during any extensions of the contract time.

TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)

Effective: 3/8/96

Revised: 10/11/13

Description. This work shall include furnishing, installing, maintaining, replacing, relocating, and removing all traffic control devices used for the purpose of regulating, warning, or directing traffic. Traffic control and protection shall be provided as called for in the plans, applicable Highway Standards, District One Expressway details, Standards and Supplemental Specifications, these Special Provisions, or as directed by the Engineer.

General. The governing factor in the execution and staging of work for this project is to provide the motoring public with the safest possible travel conditions on the expressway through the construction zone. The Contractor shall arrange his operations to keep the closing of lanes and/or ramps to a minimum.

The Contractor shall be responsible for the proper location, installation, and arrangement of all traffic control devices. Special attention shall be given to existing warning signs and overhead guide signs during all construction operations. Warning signs and existing guide signs with down arrows shall be kept consistent with the barricade placement at all times. The Contractor shall immediately remove, completely cover, or turn from the motorist's view all signs which are inconsistent with lane assignment patterns.

The Contractor shall coordinate all traffic control work on this project with adjoining or overlapping projects, including barricade placement necessary to provide a uniform traffic detour pattern. When directed by the Engineer, the Contractor shall remove all traffic control devices that were furnished, installed, or maintained by him under this contract, and such devices shall remain the property of the Contractor. All traffic control devices shall remain in place until specific authorization for relocation or removal is received from the Engineer.

Additional requirements for traffic control devices shall be as follows.

- (a) Traffic Control Setup and Removal. The setting and removal of barricades for the taper portion of a lane closure shall be done under the protection of a vehicle with a truck/trailer mounted attenuator and arrow board per State Standard 701428 and the Traffic Control Setup and Removal Freeway/Expressway BDE Special Provision. Failure to meet this requirement will be subject to a Traffic Control Deficiency. The deficiency will be calculated as outlined in Article 105.03 of the Standard Specifications. Truck/trailer mounted attenuators shall comply with Article 1106.02(g) or shall meet the requirements of NCHRP 350 Test Level 3 with vehicles used in accordance with manufacturer's recommendations and requirements.
- (b) Sign Requirements
- (1) Sign Maintenance. Prior to the beginning of construction operations, the Contractor will be provided a sign log of all existing signs within the limits of the construction zone. The Contractor is responsible for verifying the accuracy of the sign log. Throughout the duration of this project, all existing traffic signs shall be maintained by the Contractor. All provisions of Article 107.25 of the Standard Specifications shall apply except the third paragraph shall be revised to read: "The Contractor shall maintain, furnish, and replace at his own expense, any traffic sign or post which has been damaged or lost by the Contractor or a third party. The Contractor will not be held liable for third party damage to large freeway guide signs".
- (2) Work Zone Speed Limit Signs. Work zone speed limit signs shall be installed as required in Article 701.14(b) and as shown in the plans and Highway Standards. Based upon the existing posted speed limit, work zone speed limits shall be established and signed as follows.
- a. Existing Speed Limit of 55mph or higher. The initial work zone speed limit assembly, located approximately 3200' before the closure, and shall be 55mph as shown in 701400. Additional work zone 45mph assemblies shall be used as required according to Article 701.14(b) and as shown in the Highway Standards and plans. WORK ZONE SPEED LIMIT 55 PHOTO ENFORCED assemblies may be omitted when this assembly would normally be placed within 1500 feet of the END WORK ZONE SPEED LIMIT sign.
- b. Existing Speed Limit of 45mph. The advance 55mph work zone speed limit assembly shown in 701400 shall be replaced with a 45mph assembly. Additional work zone 45mph assemblies shall be used as required according to Article 701.14(b) and as shown in the Highway Standards and plans. WORK ZONE SPEED LIMIT 55 PHOTO ENFORCED assemblies shall be eliminated in all cases. END WORK ZONE SPEED LIMIT signs are required.
- (3) Exit Signs. The exit gore signs as shown in Standard 701411 shall be a minimum size of 48 inch by 48 inch with 12 inch capital letters and a 20 inch arrow. EXIT OPEN AHEAD signs shown in Standard 701411 shall be a minimum size of 48 inch by 48 inch with 8 inch capital letters.

- (4) Uneven Lanes Signs. The Contractor shall furnish and erect "UNEVEN LANES" signs (W8-11) on both sides of the expressway, at any time when the elevation difference between adjacent lanes open to traffic equals or exceeds one inch. Signs shall be placed 500' in advance of the drop-off, within 500' of every entrance, and a minimum of every mile.
- (c) Drums/Barricades. Check barricades shall be placed in work areas perpendicular to traffic every 1000', one per lane and per shoulder, to prevent motorists from using work areas as a traveled way. Check barricades shall also be placed in advance of each open patch, or excavation, or any other hazard in the work area, the first at the edge of the open traffic lane and the second centered in the closed lane. Check barricades, either Type I or II, or drums shall be equipped with a flashing light.
- To provide sufficient lane widths (10' minimum) for traffic and also working room, the Contractor shall furnish and install vertical barricades with steady burn lights, in lieu of Type II or drums, along the cold milling and asphalt paving operations. The vertical barricades shall be placed at the same spacing as the drums.
- (d) Vertical Barricades. Vertical barricades shall not be used in lane closure tapers, lane shifts, exit ramp gores, or staged construction projects lasting more than 12 hours. Also, vertical barricades shall not be used as patch barricades or check barricades. Special attention shall be given, and ballast provided per manufacture's specification, to maintain the vertical barricades in an upright position and in proper alignment.
- (e) Temporary Concrete Barrier Wall. Prismatic barrier wall reflectors shall be installed on both the face of the wall next to traffic, and the top of sections of the temporary concrete barrier wall as shown in Standard 704001. The color of these reflectors shall match the color of the edgelines (yellow on the left and crystal or white on the right). If the base of the temporary concrete barrier wall is 12 inches or less from the travel lane, then the lower slope of the wall shall also have a 6 inch wide temporary pavement marking edgeline (yellow on the left and white on the right).

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing, installing, maintaining, replacing, relocating, and removing traffic control devices required in the plans and these Special Provisions. Traffic control and protection required under Standards 701101, 701400, 701401, 701402, 701406, 701411, 701416, 701426, 701428, 701446, 701901 and District details TC-8, TC-9, TC-17, TC-18 and TC-25 will be included with this item.

Basis of Payment.

- (a) This work will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS). This price shall be payment in full for all labor, materials, transportation, handling, and incidental work necessary to furnish, install, maintain, replace, relocate, and remove all Expressway traffic control devices required in the plans and specifications.

In the event the sum total value of all the work items for which traffic control and protection is required is increased or decreased by more than ten percent (10%), the contract bid price for TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS) will be adjusted as follows:

$$\text{Adjusted contract price} = .25P + .75P [1 \pm (X - 0.1)]$$

Where: "P" is the bid unit price for Traffic Control and Protection

$$\text{Where: "X"} = \frac{\text{Difference between original and final sum total value of all work items for which traffic control and protection is required}}{\text{Original sum total value of all work items for which traffic control and protection is required.}}$$

The value of the work items used in calculating the increase and decrease will include only items that have been added to or deducted from the contract under Article 104.02 of the Standard Specifications and only items which require use of Traffic Control and Protection.

- (b) The Engineer may require additional traffic control be installed in accordance with standards and/or designs other than those included in the plans. In such cases, the standards and/or designs will be made available to the Contractor at least one week in advance of the change in traffic control. Payment for any additional traffic control required will be in accordance with Article 109.04 of the Standard Specifications.
- (c) Revisions in the phasing of construction or maintenance operations, requested by the Contractor, may require traffic control to be installed in accordance with standards and/or designs other than those included in the plans. Revisions or modifications to the traffic control shown in the contract shall be submitted by the Contractor for approval by the Engineer. No additional payment will be made for a Contractor requested modification.
- (d) Temporary concrete barrier wall will be measured and paid for according to Section 704.
- (e) Impact attenuators, temporary bridge rail, and temporary rumble strips will be paid for separately.
- (f) Temporary pavement markings shown on the Standard will be measured and paid for according to Section 703 and Section 780.
- (g) All pavement marking removal will be measured and paid for according to Section 703 or Section 783.
- (h) Temporary pavement marking on the lower slope of the temporary concrete barrier wall will be measured and paid for as TEMPORARY PAVEMENT MARKING, 6".
- (i) All prismatic barrier wall reflectors will be measured and paid for according to the Recurring Special Provision Guardrail and Barrier Wall Delineation.

TRAFFIC CONTROL SURVEILLANCE, EXPRESSWAYS

Effective: 10/25/95

Revised: 1/9/98

The contractor shall provide a person with a vehicle to survey, inspect and maintain all temporary traffic control devices when a lane is closed to traffic and when hazards are present adjacent to or within 10 foot of the edge of pavement for more than 24 hours.

The surveillance person is required to drive through the project, to inspect all temporary traffic control devices, to correct all traffic control deficiencies, if possible, or immediately contact someone else to make corrections and to assist with directing traffic until such corrections are made, at intervals not to exceed 4 hours. This person shall list every inspection on an inspection form, furnished by the Engineer, and shall return a completed form on the first working day after the inspections are made.

The Contractor shall supply a telephone staffed on a 24-hour-a-day basis to receive any notification of any deficiencies regarding traffic control and protection or receive any request for improving, correcting or modifying traffic control, installations or devices, including pavement markings. The Contractor shall dispatch additional men, materials and equipment as necessary to begin to correct, improve or modify the traffic control as directed, within one hour of notification by this surveillance person or by the Department. Upon completion of such corrections and/or revisions, the Contractor shall notify the Department's Communication Center at (847) 705-4612.

Method of Measurement: Traffic Control Surveillance will be measured on calendar day basis. One calendar day is equal to a minimum of six (6) inspections. The inspections shall start within 4 hours after the lane is closed to traffic or a hazard exists within 10 foot from the edge of pavement and shall end when the lane closure or hazard is removed.

Basis of Payment: Surveillance will be paid for at the contract unit price per calendar day or fraction thereof for TRAFFIC CONTROL SURVEILLANCE, EXPRESSWAYS. The price shall include all labor and equipment necessary to provide the required inspection and maintenance on the expressway and on all cross streets which are included in the project. The cost of the materials for the maintenance of traffic control devices shall be included in the traffic control pay items.

TEMPORARY INFORMATION SIGNING

Effective: November 13, 1996

Revised: January 02, 2007

Description. This work shall consist of furnishing, installing, maintaining, relocating for various states of construction and eventually removing temporary informational signs. This also includes the Advanced Warning Sign for use on arterial roads as described herein. These signs may be ground mounted, skid mounted, truss mounted, bridge mounted or overlaid sign panels which cover portions of existing signs.

Materials. Materials shall be according to the following Articles of Division 1000 - Materials:

<u>Item</u>	<u>Article/Section</u>
(a) Sign Base (Notes 1 & 2)	1090
(b) Sign Face (Note 3)	1091
(c) Sign Legends	1091
(d) Sign Supports	1093
(e) Overlay Panels (Note 4)	1090.02
Note 1	The Contractor may use 5/8 inch (16 mm) instead of 3/4 inch (19 mm) thick plywood.
Note 2	Type A sheeting can be used on the plywood base.
Note 3	All sign faces shall be Type A except all orange signs shall meet the requirements of Article 1106.01.
Note 4	The overlay panels shall be 0.08 inch (2 mm) thick.

GENERAL CONSTRUCTION REQUIREMENTS

Installation: The sign sizes and legend sizes shall be verified by the Contractor prior to fabrication.

Signs which are placed along the roadway and/or within the construction zone shall be installed according to the requirements of Article 720.04. The signs shall be 7 ft. (2.1 m) above the near edge of the pavement and shall be a minimum of 2 ft. (600 mm) beyond the edge of pavement. A minimum of three (3) posts shall be used.

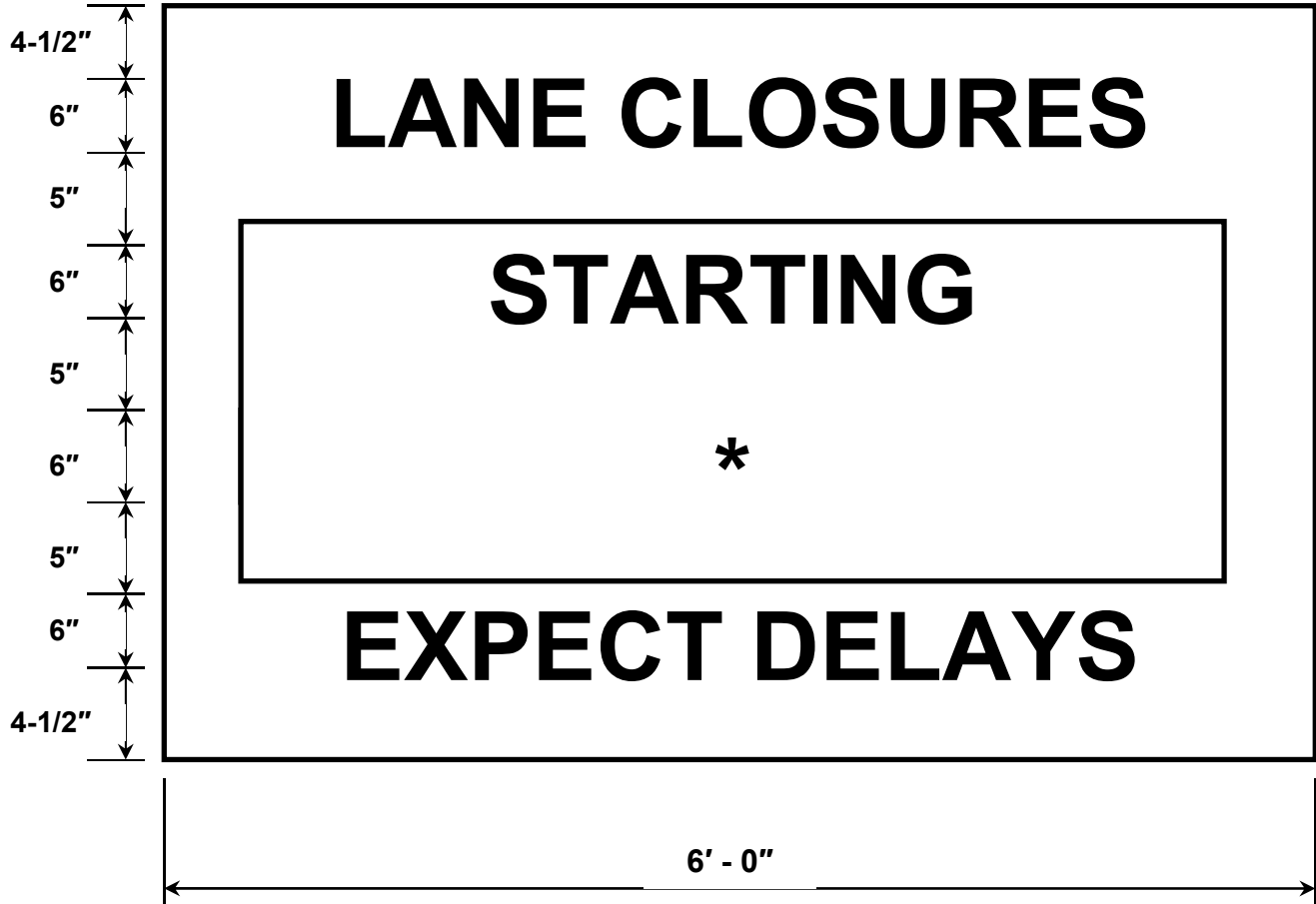
The attachment of temporary signs to existing sign structures or sign panels shall be approved by the Engineer. Any damage to the existing signs due to the Contractor's operations shall be repaired or signs replaced, as determined by the Engineer, at the Contractor's expense.

Signs which are placed on overhead bridge structures shall be fastened to the handrail with stainless steel bands. These signs shall rest on the concrete parapet where possible. The Contractor shall furnish mounting details for approval by the Engineer.

Method of Measurement: This work shall not be measured for payment.

All hardware, posts or skids, supports, bases for ground mounted signs, connections, which are required for mounting these signs will be included as part of this pay item.

Basis of Payment. This work shall be paid for at the contract until price per square foot for TEMPORARY INFORMATION SIGNING, which price shall be full compensation for all labor, equipment and materials required for performing the work as herein specified.



* Contractor shall provide overlay panel with the date for Start of lane closure. Signs shall be erected a minimum of one (1) week in advance of the start of the work. Overlay panel shall be removed soon after start of construction.

ADVANCED WARNING SIGN DETAIL
FOR ARTERIAL TRAFFIC

TRAFFIC CONTROL FOR WORK ZONE AREAS

Effective: 9/14/95

Revised: 1/1/07

Work zone entry and exit openings shall be established daily by the Contractor with the approval of the Engineer. All vehicles including cars and pickup trucks shall exit the work zone at the exit openings. All trucks shall enter the work zone at the entry openings. These openings shall be signed in accordance with the details shown elsewhere in the plans and shall be under flagger control during working hours.

The Contractor shall plan his trucking operations into and out of the work zone as well as on to and off the expressway to maintain adequate merging distance. Merging distances to cross all lanes of traffic shall be no less than 1/2 mile. This distance is the length from where the trucks enter the expressway to where the trucks enter the work zone. It is also the length from where the trucks exit the work zone to where the trucks exit the expressway. The stopping of expressway traffic to allow trucks to change lanes and/or cross the expressway is prohibited.

Failure to comply with the above requirements will result in a Traffic Control Deficiency charge. The deficiency charge will be calculated as outlined in Article 105.03 of the Standard Specifications. The Contractor will be assessed this daily charge for each day a deficiency is documented by the Engineer.

SIGN SHOP DRAWING SUBMITTAL

Effective: January 22, 2013

Add the following paragraph to Article 720.03:

“Shop drawings will be required, according to Article 105.04, for all Arterials/Expressway signs except standards/highway signs covered in the MUTCD. Shop drawings shall be submitted to the Engineer for review and approval prior to fabrication. The shop drawings shall include dimensions, letter sizing, font type, colors and materials.”

TRAFFIC SURVEILLANCE. – GENERAL (TSC T 400#02)

Effective: June 1, 1994

Revised: July 21, 2011

1.0 The following supplements applicable sections of Section 800 of the Standard Specifications for Road and Bridge Construction.

The intent of this Special Provision is to prescribe the materials and construction methods commonly used in traffic surveillance installations. All material furnished shall be new. The locations and the details of all installations shall be as indicated on the Plans or as directed by the Engineer.

When the road is open to traffic, except as otherwise provided, the Contractor may request a turn on and inspection of all complete traffic surveillance installations system. This request must be made to the Engineer a minimum of seven (7) working days prior to the time of the requested inspection. Upon demonstration that all surveillance is operational and all work is completed in accordance with the contract and to the satisfaction of the Bureau of Traffic Operations Electrical Engineer, The Bureau of Traffic Operations Electrical Engineer will then allow all of the surveillance to be placed in continuous operation. The Agency that is responsible for the maintenance of the traffic surveillance installations will assume the maintenance upon successful completion of this inspection.

Projects which call for the storage and re-use of existing traffic surveillance equipment shall have a 30 day test period prior to project acceptance.

1.1 DEFINITION OF TERMS.

Whenever in these Special Provisions the following terms are used, the intent and meaning shall be interpreted as follows:

Induction Loop - A continuous non-spliced wire, three turns, permanently placed and sealed in sawcuts in the roadway and adjacent area, used in conjunction with an induction loop detector sensor unit.

State Highway Communications Center - The main communication control facility of the Illinois Department of Transportation with present offices at 201 W. Center Court, Schaumburg, Illinois 60196-1096.

1.2 PROSECUTION OF SURVEILLANCE WORK.

The work shall be as indicated on the Plans and as required by the Specifications. Unless otherwise indicated, the Contractor shall furnish and install all required materials and equipment, including all associated appurtenances, to produce a complete and operational installation. The appurtenances shall be as indicated, and the costs shall be included in the unit prices bid for the pay items of this contract. The work shall be done in a workmanlike manner.

1.3 CONNECTIONS TO EXISTING INSTALLATIONS.

Where new work connects to existing installations, the Contractor shall do all necessary cutting, fitting and foundation drilling to the existing installation and shall remove all existing work, as required, to make satisfactory connections, with the work to be performed under these Provisions, so as to leave the entire work in a finished and workmanlike manner, as approved by the Bureau of Traffic Operations Electrical Engineer. No raceways shall be allowed to enter cabinet through the sides or back walls.

Some contracted work which does not call for a complete rebuilding of a surveillance location but the replacement of detector loops and lead-in cable only in conjunction with work such as pavement overlay, cut and grind, curb and gutter replacement and other similar type work where existing appurtenances have been in place for several years. This at times has created pre-existing conditions (such as blocked/broken lead-in conduits, buried handholes) which the contractor may have to repair/replace to make the location fully functioning. The Contractor will be compensated for such work utilizing contract items after a complete inspection by the Bureau of Traffic Operations Electrical Engineer, Resident Engineer and Electrical Maintenance Contractor's Rep. with a full review on a case by case basis. Upon completing such work the Contractor shall notify the R.E. to contact the Bureau of Traffic Operations Electrical Engineer for checks and test to insure the location is on-line and working correctly.

The Contractor shall furnish all labor and material to the furtherance of this end, whether or not distinctly shown on the plans, in any of the "Standard Specifications" or in the Special Provisions.

Note that the Contractor shall be entitled to only one request for location marking of existing systems by the Electrical Maintenance Contractor and that multiple requests may only be honored at the Contractor's expense.

1.4 STANDARD GUARANTEE.

Manufacturers' warranties or guarantees on all electrical and mechanical equipment consistent with those provided as customary trade practice shall be obtained and transferred to the State.

1.5 IN-SERVICE WARRANTIES OR GUARANTEES.

The Contractor shall provide warranties or guarantees that will provide for satisfactory in-service operation of the mechanical and electrical equipment and related components. These warranties or guarantees shall cover a period of two (2) years following project acceptance. The cost of these warranties and guarantees shall be considered incidental to the Contract.

1.6 EQUIPMENT DOCUMENTS.

The Contractor shall furnish five (5) diagrams of the internal and external connection of the equipment in each Bureau of Traffic Operations Electrical cabinet. Contractor shall also furnish the Operating and maintenance instructions for all equipment supplied. One copy of the wiring diagrams for each cabinet shall be retained in each field cabinet. A wiring diagram shall be contained in a plastic pouch that shall be permanently mounted to the door of each cabinet. Contractor shall permanently mark the cabinet for each termination and each terminal connection as to loop, tone, closure, phone, and lane function of each termination in the cabinet and provide a completed cable log and location as-built diagram at each location.

1.7 TERMINAL BLOCKS.

Terminal blocks provided in field cabinets shall be the heavy duty barrier type. The terminal block shall be a minimum of 2 inches (50.8 mm) wide and 1-3/16 inch (30.16 mm) deep. Center to center of the terminal screws or studs shall be a minimum of 21/32 inch (16.67 mm) with barriers in between. Terminal blocks shall be rated at 45 amps 600 volts breakdown RMS line to line 11,000 V. and breakdown RMS line to ground 13,800 V. A marking strip shall be provided with each terminal block.

1.8 EXISTING EQUIPMENT.

All existing equipment, replaced by new equipment shall remain the property of the State and shall be delivered to the Electrical Maintenance Contractor. The cost of removing and delivering the replaced equipment shall be paid for under separate pay item for Cabinet Housing Equipment - Removal.

1.9 TELECOMMUNICATION CABLE.

When installing the telecommunication cable, the Contractor shall extend his installation and connections of the cable to the next adjacent Surveillance installations or junction box, beyond the limits of his contract section. He shall be responsible for insuring that the cable is continuous and connected from one contract section to the other.

The Contractor shall comply with the agreement between the State of Illinois and IBT/Ameritech as to connections, locations, and terminations of the phone lines (Telephone Company, Engineering, General Service Engineering Division, Outside Plant Engineering Notes 14-36A., March 1971, Administrative Aids and Procedures).

1.10 EXISTING SURVEILLANCE EQUIPMENT AND APPURTENANCES.

Before starting work, the Contractor, in the presence of the Resident Engineer, Bureau of Traffic Operations Electrical Engineer and the State Electrical Maintenance Contractor's rep., shall inspect the existing equipment to be delivered or maintained by the Contractor and shall take an inventory of all defective, broken, and/or missing parts. Those parts found broken, defective, and/or missing shall be repaired or replaced by the State Electrical Maintenance contractor and shall be recorded as such. The Contractor shall be required to maintain all tone transmitters, tone receivers, tone power supplies, tone mounting frames, harnesses, controller and wiring. The Contractor shall be required to maintain all metering and surveillance cabinets, foundation, concrete handhole, vehicle detection equipment, all interconnecting cables and all Surveillance appurtenances including signal heads. Contractor shall number each cabinet as indicated on the plans, with reflective decals as those used on lighting pole standard.

Should damage occur to any surveillance items during the Contractor's contract period, the Contractor shall repair or replace all damaged equipment at his own expense. The Bureau of Traffic Operations Electrical Engineer shall determine what equipment shall be reusable and what shall be replaced. Replaced equipment shall be of equal or better quality and type.

The Contractor, prior to the commencement of his work, shall notify the Bureau of Traffic Operations Electrical Engineer for a pre-construction inspection. If construction begins prior to this meeting, the Contractor assumes maintenance responsibilities of the locations within his contract limits and shall make any repairs or replace any damaged equipment pre-existing or damaged as a result of his own negligence at his own expense. This also relieves the Electrical Maintenance Contractor of providing one free locate of the surveillance installations within the contract limits.

1.11 AS-BUILT PLANS.

Upon completion of the work, the Contractor shall furnish one (1) copy of "as-built" drawings on CD compatible with Micro Station V8-2004 Edition software at the Bureau of Traffic Operations Electrical Design Section and four (4) full size sets of "as-built" plans to the Resident Engineer. The plans shall include definite locations and length of all cables, duct, conduit pushes, induction loop, lead-in, foundations, handhole and P-duct. The cost of the "as-built" plans shall be incidental to the contract. The Engineer will not authorize final inspection of any installations until the said plans are in his possession.

1.12 PROTECTION OF THE WORK.

Electrical work, equipment and appurtenances shall be protected from damage during construction until final acceptance. Electrical raceway or duct openings, shall be capped or sealed from the entrance of water and dirt. Wiring shall be protected from mechanical injury.

1.13 STANDARDS OF INSTALLATION.

Electrical work shall be installed in a neat and workmanlike manner in accordance with the best practices of the trade. Unless otherwise indicated, materials and equipment shall be installed in accordance with the manufacturer's recommendations.

Except as specified elsewhere herein, materials and equipment shall be in conformance with the requirements of Section 800 & 1088 of the Standard Specifications for Road and Bridge Construction.

In addition to the requirements of the Standard Specifications relating to control of materials, the Contractor shall comply with the following requirements.

The Contractor shall supply samples of all wire, cable, and equipment and shall make up and supply samples of each type of cable splice proposed for use in the work for the Engineer's approval.

Before equipment and/or material including cabinet, telemetry, and detectors are delivered to the job site, the Contractor shall obtain and forward to the Engineer a certified, notarized statement from the manufacturer, containing the catalog numbers of the equipment and/or material, guaranteeing that the equipment and/or material, after manufacture, comply in all respects with the requirements of the Specifications and these Special Provisions. Re-manufactured or modified equipment other than by the original manufacturer shall not be allowed. Original manufacturer shall certify that he made modification to the equipment.

All cost of work and materials required to comply with the above requirements shall be included in the pay item bid prices, under which the subject materials and equipment are paid, and no additional materials and equipment are paid, and no additional compensation will be allowed. Materials and equipment not complying with the above requirements that have been installed on the job will be done at the Contractor's own risk and may be subject to removal and disposal at the Contractor's expense.

1.14 PROCUREMENT.

Materials and equipment shall be the products of established manufacturers, shall be new, and suitable for the service required. The Contractor is obligated to conduct his own search into the timely availability of the specified equipment and to ensure that all materials and equipment are in strict conformance with the contract documents. Materials or equipment items which are similar or identical shall be the product of the same manufacturer. The cost of submittals, certifications, any required samples and similar costs shall not be paid for extra but shall be included into the pay item bid price for the respective material or work.

1.15 EXCEPTIONS, DEVIATIONS AND SUBSTITUTIONS.

Exceptions to and deviations from the requirements of the Contract Documents shall not be allowed without approval by Engineer and Bureau of Traffic Operations Electrical Engineer. It is the Contractor's responsibility to note any deviations from contract requirements at the time of submittal and to make any requests for deviations in writing to the Engineer. In general, substitutions will not be acceptable. Requests for substitutions must demonstrate that the proposed substitution is superior to the material or equipment required by the Contract Documents. No substitutions shall be permitted without the approval of the Engineer, and Bureau of Traffic Operations Electrical Engineer.

1.16 SUBMITTALS.

Within 30 days after contract award, the Contractor shall submit, for approval, complete manufacturer's product data (for standard products and components) and detailed shop drawings (for fabricated equipment). All of the submittal information shall be assembled by the Contractor and submitted to the Engineer at one time. All equipment samples shall be submitted at this time. Partial and sporadic submittals may be returned without review. The Contractor may request, in writing, permission to make a partial submittal. The Engineer will evaluate the circumstances of the request and may accept to review such a partial submittal. However, no additional compensation or extension of time shall be allowed for extra costs or delays incurred due to partial or late submittals.

1.17 TESTING.

Before final acceptance, the electrical equipment, material, induction loops and work provided under this contract shall be tested. Tests will not be made progressively, as parts of the work are completed they shall be all made at one time. Items which fail to test satisfactorily shall be repaired or replaced. Bureau of Traffic Operations Electrical Engineer will witness all testing.

1.18 INSTALLATION/INSPECTION PROCEDURES.

After all control boxes and equipment to be installed has been physically inspected and approved by Bureau of Traffic Operations Electrical Engineer, the equipment supplier shall then deliver all equipment to the job site. The Contractor shall then install/safeguard all the equipment which has been delivered prior to requesting an inspection. No unapproved equipment shall be on the job site or installed as part of the job. This does not relieve the Contractor from replacement/repairs of equipment found to be damaged or in non-compliance of these provisions.

Certain items such as conduit, wire, duct, anchor bolts, and junction boxes will be inspected and may be tested by the Department's Bureau of Materials and these items shall not be delivered to the job site without inspection approval. Items such as cabinets shall be inspected by the Engineer at the contractor's or manufacturer's shop and these items shall not be delivered to the job site without Bureau of Traffic Operations Electrical Engineer inspection approval. It shall be the Contractor's responsibility to arrange inspection activities with the Engineer thirty (30) days prior to installation. 30 days prior to installation of the tone equipment being supplied and, prior to request for a turn-on, the Bureau of Traffic Operations Electrical Engineer will be contacted for the correct frequencies, controller addresses and "DB" setting for each location to be installed. When the work is complete, all equipment fully operational, the Contractor shall schedule a turn-on inspection with the Engineer. Acceptance will be made as a total system, not as parts. The Contractor shall request the inspection no less than seven (7) working days prior to the desired inspection date.

No inspection shall be made until the delivery of acceptable "as built" drawings, specified certifications, and the required guarantees.

It will be the responsibility of the installing contractor to provide a qualified technician representing the tone equipment supplier to be at the turn-on inspection of each location to provide the technical expertise to bring each location on line.

The Contractor shall furnish the necessary manpower and equipment to make the Inspection. The Engineer may designate the type of equipment required for the inspection tests.

A written record of the loop analyzer readings shall be submitted to the Bureau of Traffic Operations Electrical Engineer prior to the final inspection.

Any part or parts of the installation that are missing, broken, defective, or not functioning properly during the inspection shall be noted and shall be adjusted, repaired, or replaced as directed by the Engineer and another inspection shall be made at another date. Only upon satisfaction of all points shall the installation be acceptable.

After the subject inspections are completed the Bureau of Traffic Operations Electrical Engineer will provide the contractor with a complete punch list of items necessary to be completed prior to final inspection and acceptance for maintenance.

The Contractor shall furnish a written guarantee for all materials, equipment and work performed under the contract for a period of not less than two (2) years from the date of final acceptance.

ELECTRIC CABLE NO. 19 - 6 CONDUCTORS OR 12 CONDUCTORS (TSC T 421#2)

Effective: June 1, 1994

Revised: May 12, 2008

Description. This item shall consist of furnishing and installing telephone cable intended for direct burial in P-duct or G.S. conduit. The number of conductors shall be twisted into pairs stranded into a cable core and enclosed in two polyethylene jackets, with a copper shield between the inner and outer jackets. All No. 19 electric cable shall conform with these specifications and the current addition of the Rural Electrification Specification for fully color-coded, polyethylene or crystalline propylene/ethylene copolymer-insulated, double polyethylene copolymer-insulated, double polyethylene-jacketed telephone cables for direct burial PE 54. The No. 19 cables shall be installed in complete spans.

Material and Testing. No. 19 electric cable shall meet the requirement set forth in the REA Specification PE 54.

Construction.

CONDUCTORS: Each conductor shall be a solid round wire of commercially pure annealed copper. Conductors shall meet the requirements of ASTM Designation B-3, latest issue, except that the requirements for dimensions and permissible variations are waived.

CONDUCTOR INSULATION: Each conductor shall be insulated with colored insulating grade high density polyethylene or crystalline propylene/ethylene copolymer. The manufacturer shall have the option of using either of the above materials.

IDENTIFICATION OF PAIRS: The polyethylene or propylene copolymer compounds used for conductor insulation shall be colored so as to identify (1) the "tip" and "ring" conductor of each pair, and (2) each pair in the completed cable.

STANDARDS OF COLOR: The colors of insulated conductors supplied in accordance with this specification shall fall within the limits of standards of color as defined by the Munsell Color Notations specified in paragraph 4.031.

TWISTING OF PAIRS: The insulated conductors shall be twisted into pairs.

In order to provide sufficiently high crosstalk losses at voice and carrier frequencies, the pair twists shall be designed to enable the cable to meet the pair-to-pair capacitance unbalance requirements and the crosstalk requirements.

CORE COVERING: The core shall consist of an inner jacket of polyethylene applied over the completed core, a metal shield, and an outer jacket of polyethylene.

SHIELD: A gopher-resistant corrugated shield of fully annealed copper shall be applied longitudinally over the inner jacket. The shield shall completely cover the inner jacket and shall be so constructed that the completed cable shall meet the bending requirements given in paragraph 9 of Rural Electrification Specification PE-54. The shield shall provide 100% electrical shielding plus resistance to gopher attack or other severe service conditions.

MUTUAL CAPACITANCE: The average mutual capacitance of all pairs in any reel shall be in accordance with the following table:

<u>Number of Cable Pairs</u>	<u>Average Mutual Capacitance</u>	
	<u>mf/mile</u>	<u>(mf/km)</u>
3	0.083 plus or minus 0.010	(0.052 plus or minus 0.006)
6, 12	0.083 plus or minus 0.007	(0.052 plus or minus 0.004)
18 or more	0.083 plus or minus 0.004	(0.052 plus or minus 0.002)

Mutual capacitance is the effective capacitance between the two wires of a pair.

CAPACITANCE UNBALANCE: (Pair to Pair): Pair-to-pair capacitance unbalances as measured on the completed cable at a frequency of 1000 plus or minus 100 Hz shall not exceed the following values:

<u>Number of Cable Pairs</u>	<u>Pair-to-Pair Capacitance Unbalance (Max)</u>	
	<u>mmf/kft</u>	<u>(mmf/km)</u>
Less than 12	<u>100</u>	<u>(181.1)</u>

CAPACITANCE UNBALANCE - (Crosstalk Loss): The r.m.s. output-to-output far-end crosstalk loss as measured on the completed cable at a frequency of 150 kHz shall be not less than 73 db per 1,000 feet (67.8 db per kilometer) for cable sizes of 6 pairs and larger. The r.m.s. calculation shall be based on the combined total of all adjacent and alternate pair combinations within the same layer and center to first layer pair combinations.

CAPACITANCE UNBALANCE - (Pair to Shield): Pair-to-shield direct capacitance unbalances as measured on the completed cable at a frequency of 1000 plus or minus 100 Hz shall not exceed the following values:

<u>Cable Pairs</u>	<u>Pair-to-Shield Unbalance (Max)</u>	
	<u>mmf/kf</u>	<u>(mmf/km)</u>
Less than 12	<u>250</u>	<u>(820)</u>

CONDUCTOR RESISTANCE: The d.c. resistance of any conductor as measured on the completed cable shall not exceed the following values when measured at or corrected to 20° C.

<u>AWG</u>	<u>Maximum Resistance</u> <u>ohms/kf (ohms/km)</u>
19	8.7 (28.5)

Basis of Payment. This work will be paid for at the contract price per lineal foot (meter) for ELECTRIC CABLE IN CONDUIT, COMMUNICATIONS, NO. 19 of the number of conductors specified, for furnishing all materials, making all electrical connection and installing the cable in place.

HANDHOLE (TSC T 428#1)

Effective: June 1, 1994

Revised: May 19, 2009

Description. This item shall consist of constructing a handhole, a heavy-duty handhole, or a double handhole, cast in place, complete with frame and cover and in accordance with the following requirements and conforming in all respects to the lines, grades, and dimensions shown on the plans or as directed by the Engineer. All handholes shall be installed in accordance with the Standard Specifications Sec. 814.

Materials. All handholes shall be constructed of Class SI concrete meeting the requirements of the Standard Specifications for Road and Bridge Construction Section 1020.

Construction Details. Handhole of the type specified shall be constructed in accordance with the details shown on the plans and conform to the following requirements:

1. **Concrete:** Concrete construction shall be done in accordance with the provisions of Concrete for Structures and Incidental Construction contained in the Standard Specifications for Road and Bridge Construction Sec. 503.
2. **Placing Castings:** Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary. Castings shall be set flush with a sidewalk or pavement surface. When installed in an earth shoulder away from the pavement edge, the top surface of the casting shall be 1 in. (25.4mm) above the finished surface of the ground.
3. **Backfilling:** Any backfilling necessary under a pavement, shoulder, sidewalk or within 2 ft. (60 cm) of the pavement edge shall be made with sand or stone screenings.
4. **Forming:** Forms will be required for the inside face of the handhole wall, and across all trenches leading into the handholes excavation. The ends of conduits leading into the handhole shall fit into a conduit bell which shall fit tightly against the inside form and the concrete shall be carefully placed around it so as to prevent leakage.
5. **French Drain:** A french drain conforming to the dimensions shown on the plans shall be constructed in the bottom of the handhole excavation.

6. **Steel Hooks:** Each handhole shall be provided with four galvanized steel hooks of appropriate size, one on each wall of the handhole.
7. **Frame and Cover:** The outside of the cover shall contain a recessed ring Type "G" for lifting and a legend "IDOT TSC" cast-in.
8. **Cleaning:** The handhole shall be thoroughly cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

Basis of Payment. This work will be paid for at the contract unit price each for HANDHOLE or HEAVY DUTY HANDHOLE, or CONCRETE HEAVY DUTY HANDHOLE (SPECIAL), as the case may be, for all necessary excavating, backfilling, disposal of surplus material and form work, frame and cover, and furnishing all materials.

CONCRETE BARRIER REMOVAL

Description. This work shall consist of the removal of existing concrete barrier wall along with any barrier wall base at locations shown on the plans.

Construction Requirements. This work shall be done in accordance with the applicable portions of Section 440 of the Standard Specifications. The portion of the existing wall to be removed shall be saw cut with a concrete saw without causing damage to the portion of the existing concrete barrier wall to remain. The concrete saw shall be equipped with a diamond blade of sufficient size to saw cut reinforced concrete barrier wall full-depth and be capable of accurately maintaining cutting depth and alignment.

The Contractor shall be responsible for all damage to existing concrete barrier wall and other appurtenances to remain in place. All damage to these items shall be repaired or replaced at the Contractor's own expense, and to the satisfaction of the Engineer.

Method of Measurement. CONCRETE BARRIER REMOVAL shall be measured for payment in feet along the centerline of concrete barrier wall.

Saw cuts will not be measured for payment but shall be included in the cost of concrete barrier removal.

Basis of Payment. This work shall be measured and paid for at the contract unit price per foot yard for CONCRETE BARRIER REMOVAL, which price shall include all labor, equipment and materials necessary to remove and dispose of the concrete barrier wall and concrete barrier wall base.

REMOVAL OF EXISTING STRUCTURES

Description. This item shall consist of furnishing all labor, equipment and materials necessary for the removal and disposal of the existing Peoria Street Bridge (S.N. 016-2082) over Interstate 290 and CTA. The work shall be done in accordance with the applicable portions of Section 501 of the Standard Specifications.

All structure elements of the Peoria Street Bridge over I-290 including, but not limited to, abutments, abutments' footings, piers, piers' footings, wingwalls, beams, bearings, diaphragms, deck, sidewalk railing and fence, piles (to a depth of 1 foot below proposed structures or as noted on the Plans or directed by the Engineer) shall be included in Removal of Existing Structures.

Included in the Removal of Existing Structures shall be the removal of items and appurtenances located on, attached or adjacent to the bridge including, but not limited to, bicycle racks, CTA appurtenances and newspaper stands and highway sign structures attached to the fascia of the bridge. A University of Illinois at Chicago plaque resides on the northwest corner of the bridge. The sign shall be removed and returned to the University of Illinois at Chicago, as designated on Plans. Cost of removal and return is included in Removal of Existing Structures. Abandoned CTA foundations may be present. Cost of removal is included in Foundation Removal.

Included in the Removal of Existing Structures, shall be the complete or partial removal (to a minimum depth of 1 foot from proposed structure) of any abandoned structure elements that may interfere with the construction with the new bridge, but not including abandoned CTA elevated pier foundations. These removals will be paid for under the item FOUNDATION REMOVAL. Historical drawing of the construction of Peoria Street over I-290, dated September, 1949 indicate two rows of four (4) CTA footing foundations bearing at elevation 586.32 behind the existing north abutment. These elements shall be removed or partially removed as required.

Included in the Removal of Existing Structures, shall be the removal of the existing siphon outlet junction chamber as shown in the plans and as described in the specification SIPHON RECONSTRUCTION. The Contractor shall exercise care when removing this structure to ensure that all portions of the existing siphon and the existing siphon structures that are to remain in place are not damaged. Any damage to the existing siphon or existing siphon structures that are to remain in place shall be repaired by the Contractor to the satisfaction of the Engineer and the Chicago Department of Water Management (CDWM) at the Contractor's expense. Due to the fact that the flow through the existing siphon must be maintained throughout the removal of the existing siphon outlet junction chamber, it is critical for the Contractor tasked with removing the existing siphon outlet junction chamber to coordinate this work with all other Contractors working on the siphon reconstruction. The Contractor tasked with removing the existing siphon outlet junction chamber shall also refer to the specification SIPHON RECONSTRUCTION for additional information regarding the removal of the existing siphon outlet junction chamber.

Included the Removal of Existing Structures shall be coordination with the City of Chicago, Bureau of Electricity (BOE) for the removal of street light and traffic signal poles and equipment by the BOE. The contractor shall remove all embedded conduits and hand or manholes. Conduits for other utilities attached to the existing structure using supports and hangers are anticipated to be removed by others prior to the beginning of work under this item. The City of Chicago has identified that records are unclear if asbestos concrete is present in the existing conduits. The City of Chicago will remove cables and wire in advance of the conduit removal unless the City of Chicago determines that cables are not live and can be removed as part of the bridge demolition. Included in the Removal of Existing Structures prior to any removal of conduit material, the existing City of Chicago conduits must be tested for the presence of asbestos content by qualified personal and/or qualified testing firm. Tests shall be comprehensive, and include detail visual inspection, sampling as determined by qualified testing firm or personnel and laboratory testing for samples in order to determine if conduits included asbestos cement. Each of the existing conduits should be independently reviewed due to unknown installation or maintenance improvement records. All testing records and results shall be provided to the Engineer prior to any removal of existing City of Chicago conduits. Conduits that are determined to contain asbestos will be removed in accordance with REMOVAL OF ASBESTOS CEMENT CONDUIT. Otherwise, the conduits shall be removed under the requirements of this section and will not be paid for separately.

Included in the Removal of Existing Structures, the Contractor shall coordinate with ComEd, AT&T, City of Chicago Office of Emergency Management and Communications (OEMC 911) and City of Chicago Department of Electric Operations. The Contractor is required to coordinate the removal of ComEd, AT&T and City conduits. Existing conduits and wires owned by ComEd, AT&T and City Electric will be removed by ComEd, AT&T and City Electric.

Included in the Removal of Existing Structures is partial removal of CTA station located on Span 2, as specified on the plans. The Contractor shall notify the Chicago Transit Authority at least three (3) weeks prior to removal of the following items from the existing brick station house on the bridge, including but not limited to: revenue collecting machines, agents kiosk, turnstiles, rotogates, transportation information boards, train arrival/departure information signs, advertising displays, miscellaneous signage, trash receptacles, benches, bike rack (inside the glass building), speakers and cameras. The Contractor shall store these items for relocation to the renovated glass building as shown on the plans and approved by the Engineer. The removal, transportation, storage and placement of these items will not be paid for separately but shall be included in the cost of Removal of Existing Structures. Any item that is damaged during removal, transport, storage or placement shall be replaced at the Contractor's own expense. The existing bridge is adjacent to the existing staircase to the CTA Blue Line station and over the CTA rail lines. The exiting staircase is to remain. All demolition activity must protect CTA property.

The close proximity of the work activities to active CTA rail tracks imposes additional safety requirements. All activities over or in CTA right-of-way must comply with all CTA requirements and CTA FLAGGING AND COORDINATION.

The work shall conform in every respect to all environmental, state and local regulations regarding construction requirements, the protection of adjacent properties, as well as dust and noise control.

Prior to commencing work under this Item, the Contractor shall verify the location of all existing utilities in the area. The Contractor shall submit drawings and written documentation to the Engineer of such verification. All work under this Item shall be executed in such a manner so as not to disturb or damage the existing utilities.

All materials removed under this Item shall become the property of the Contractor and shall be disposed of by the Contractor off the site and in a lawful manner meeting all IDOT Policies and Procedures.

Due to the concrete encasements for all or portions of the existing conduits crossing the bridge, including AT&T, ComEd and the City of Chicago, the testing of existing conduits must take place while the existing deck is still in place. To access the concrete encased ducts, partial deck removal is required. At that time, ComEd and AT&T will test the conduits and concrete encasement. If ComEd, AT&T or their subcontractors determine that there is asbestos within the concrete encased duct, then it will be the Contractor's responsibility to safely remove portions of the concrete encased duct bank for abatement by ComEd or AT&T. The removal of the concrete encased ductbank will not be paid for separately, and must follow all regulations for handling asbestos containing materials. The asbestos containing materials to be abated by ComEd or AT&T must be stockpiled on site in a safe and secure manner in accordance with all laws and regulations. The utilities will inventory and abate all concrete encased ComEd and AT&T ductbanks determined to contain asbestos. Requirements for the removal of existing ducts and concrete encased ducts shall follow the specification for REMOVAL OF ASBESTOS CEMENT CONDUIT.

Existing piles that are determined and noted in the Plans to be completely removed will be paid for separately as PILE EXTRACTION.

Traffic Operations

The traffic using Interstate I-290 must remain open to all lanes of traffic during demolition activities unless the Contractor has secured the necessary permits from the Illinois Department of Transportation to allow for temporary closure of lanes.

Rail Operations

The CTA rail traffic must remain operational at all times during demolition activities unless the Contractor has secured the necessary permits from CTA to allow for temporary halting of rail traffic.

Method of Measurement. Removal of Existing Structures and testing for asbestos content shall be measured for payment by each of the structure removed including additional elements noted above.

Basis of Payment. The work under this Item will be paid for at the Contract unit price each for REMOVAL OF EXISTING STRUCTURES, as indicated on the Plans and as specified herein.

FORM LINER TEXTURED SURFACE

The form liner textured surfaces shall conform to applicable portions of Section 503 of the Standard Specifications except as herein modified.

Description. This Work consists of designing, developing, furnishing and installing a form liner textured surface and forming concrete using reusable, high strength urethane and elastomeric form liners to achieve concrete treatment as shown on the Plans. Form liner textured surface shall be of the type specified at locations shown on the Plans or directed by the Engineer, and in accordance with the details shown in the Plans. This work shall also include furnishing and installing reveal and bevel strips.

Materials. Form liners for bridge piers shall be of high quality, highly reusable and capable of withstanding anticipated concrete pour pressures without causing leakage or physical defects. Forms for smooth surfaces shall be plastic coated to provide a smooth surface free of any impression or pattern. For surface other than form liner, and indicated on drawings as smooth surface, rubbed finish according to article Section 503, 15(b) of the Standard Specifications shall be provided.

Reveals for the retaining walls shall be made of rubber material capable of reproducing the same quality texture with extended use on flat and curved surface.

General. Liners shall be attached to each other with flush seams and seams filled necessary to eliminate visible evidence of seams in cast concrete. Liner butt joints shall be blended into the pattern so as to create no vertical joints or reveals. Concrete pours shall be continuous form liner pattern fields. Finished textures shall be continuous without visual disruption and properly aligned over adjacent and multiple liner panels. After each use, liners shall be cleaned and visually inspected. Damaged liner shall be replaced when continued use or repair would diminish the aesthetics of the Work. At the end of the work, master molds and form liners shall be turned to the Owner, delivered at location designated by the Owner, for future use on other contracts.

Submittals.

Shop drawings of the form liner texture surface shall be provided for each area of textured concrete.

1. Individual form liner pattern descriptions, dimensions and sequencing of form liner sections, typical cross sections, joints, corners, joint locations, edge treatment and any other conditions.
2. Elevation views and layouts showing the full height and length of the structure with each form liner outlined.
3. Two 24"x 24" samples of each texture and two 24"x24" samples with all textures specified, adjacent to each other.

4. Mockup of the front face of a pier with a minimum height of 4' and an approximate 6" thickness. The mockup must be available for review at the project site by the Engineer, Department staff and their designees. Mockup to be made of the concrete mix specified for structure including the final finish.

No final concrete surfaces shall be cast until the Engineer accepts the final samples and mockup after approval of any submitted materials.

Acceptable Form Liner Manufactures:

1. Custom Rock International, St Paul, MN (Jim Rogers)
2. Scott Systems, Denver, CO
3. American Formliners, Inc, Naperville, IL
4. Approved Equal.

Method of Measurement: This Work will be measured for payment, complete in place, per square feet for FORM LINER TEXTURED SURFACE.

Basis of Payment: This Work will be paid for at the Contract Unit Price per square feet for FORM LINER TEXTURED SURFACE which price includes furnishing and placing all material required, including all labor, equipment and incidentals necessary to complete the Work as herein specified.

FILLING VALVE VAULTS

Description. Work under this item will include the abandonment of existing City of Chicago Water Main vault structures as part of the abandonment of 12" water main along Peoria Street. Any existing structure along water main pipe to be abandoned or removed that does not conflict with proposed utility, sewer, bridge or roadway items may be abandoned per this specification. After the optional removal of all pipe, valves, fittings, taps and other water main elements, the brick or concrete structure must filled in conformance with Section 605 of the IDOT Standard Specifications for Road and Bridge Construction and City of Chicago Department of Water Management Standards.

Filling. No work shall proceed prior to the shutdown of any water main passing through or adjacent to the vault structure to be removed. This work will consist of removing the frame and cover of an existing vault structure, removal of valves, fittings, taps and other elements of the water system, partial removal of the structure to a minimum depth of 36 inches below proposed grade and filling the structure with either sand or controlled low strength material (CLSM). The Contractor may elect to avoid salvaging any elements of the vault structure. If this occurs, the existing elements of the structure must be removed to a minimum depth of 36 inches below proposed grade and then filled in as described. Sand must be compacted. CLSM must meet the requirements of Section 593 of the IDOT Standard Specifications for Road and Bridge Construction.

Any frames, lids, valves, fittings, taps or other water main elements that are salvaged in reasonable condition in the opinion of the Engineer may be offered to the City of Chicago Department of Water Management. Any debris, including the frame, lid, valves, fittings, taps or other items must be disposed of off-site in an approved manner. The Contractor will pay for all disposal fees.

Method of Measurement. This work will be paid for per each vault filled using methods as described. No separate measurement for materials used for the purposes of filling structures will be made.

Basis of Payment. This work will be paid for at the contract unit price per each for FILLING VALVE VAULTS which price will be payment in full for all labor and materials necessary to complete the work as described. Salvaging of any materials will be considered incidental to this item.

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES

Revise Article 669.01 of the Standard Specifications to read:

“669.01 Description. This work shall consist of the transportation and proper disposal of contaminated soil and water. This work shall also consist of the removal, transportation, and proper disposal of underground storage tanks (UST), their content and associated underground piping to the point where the piping is above the ground, including determining the content types and estimated quantities.”

Revise Article 669.08 of the Standard Specifications to read:

“669.08 Contaminated Soil and/or Groundwater Monitoring. The Contractor shall hire a qualified environmental firm to monitor the area containing the regulated substances. The affected area shall be monitored with a photoionization detector (PID) utilizing a lamp of 10.6eV or greater or a flame ionization detector (FID). Any field screen reading on the PID or FID in excess of background levels indicates the potential presence of contaminated material requiring handling as a non-special waste, special waste, or hazardous waste. No excavated soils can be taken to a clean construction and demolition debris (CCDD) facility or an uncontaminated soil fill operation with detectable PID or FID meter readings that are above background. The PID or FID meter shall be calibrated on-site and background level readings taken and recorded daily. All testing shall be done by a qualified engineer/technician. Such testing and monitoring shall be included in the work. The Contractor shall identify the exact limits of removal of non-special waste, special waste, or hazardous waste. All limits shall be approved by the Engineer prior to excavation. The Contractor shall take all necessary precautions.

Based upon the land use history of the subject property and/or PID or FID readings indicating contamination, a soil or groundwater sample shall be taken from the same location and submitted to an approved laboratory. Soil or groundwater samples shall be analyzed for the contaminants of concern, including pH, based on the property's land use history or the parameters listed in the maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605. The analytical results shall serve to document the level of soil contamination. Soil and groundwater samples may be required at the discretion of the Engineer to verify the level of soil and groundwater contamination.

Samples shall be grab samples (not combined with other locations). The samples shall be taken with decontaminated or disposable instruments. The samples shall be placed in sealed containers and transported in an insulated container to the laboratory. The container shall maintain a temperature of 39 °F (4 °C). All samples shall be clearly labeled. The labels shall indicate the sample number, date sampled, location and elevation, and any other observations.

The laboratory shall use analytical methods which are able to meet the lowest appropriate practical quantitation limits (PQL) or estimated quantitation limit (EQL) specified in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water", EPA, EMSL, EPA-600/4-88/039. For parameters where the specified cleanup objective is below the acceptable detection limit (ADL), the ADL shall serve as the cleanup objective. For other parameters the ADL shall be equal to or below the specified cleanup objective."

Replace the first two paragraphs of Article 669.09 of the Standard Specifications with the following:

“669.09 Contaminated Soil and/or Groundwater Management and Disposal. The management and disposal of contaminated soil and/or groundwater shall be according to the following:

- (a) Soil Analytical Results Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels exceed the most stringent maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605, the soil shall be managed as follows:
 - (1) When analytical results indicate inorganic chemical constituents exceed the most stringent MAC but they are still considered within area background levels by the Engineer, the excavated soil can be utilized within the construction limits as fill, when suitable. Such soil excavated for storm sewers can be placed back into the excavated trench as backfill, when suitable, unless trench backfill is specified. If the soils cannot be utilized within the construction limits, they shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.

- (2) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for a Metropolitan Statistical Area (MSA) County, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (3) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, or the MAC within the Chicago corporate limits, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County excluding Chicago or within the Chicago corporate limits provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (4) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County excluding Chicago provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (5) When the Engineer determines soil cannot be managed according to Articles 669.09(a)(1) through (a)(4) above, the soil shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.
- (b) Soil Analytical Results Do Not Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels do not exceed the most stringent MAC, the excavated soil can be utilized within the construction limits or managed and disposed of off-site as “uncontaminated soil” according to Article 202.03. However the excavated soil cannot be taken to a CCDD facility or an uncontaminated soil fill operation for the following reason.
- (1) The pH of the soil is less than 6.25 or greater than 9.0.
 - (2) The soil exhibited elevated photoionization detector (PID) utilizing a lamp of 10.6eV or greater or a flame ionization detector (FID) readings.
- (c) Soil Analytical Results Exceed Most Stringent MAC but Do Not Exceed TACO Residential. When the soil analytical results indicate that detected levels exceed the most stringent MAC but do not exceed TACO Tier 1 Soil Remediation Objectives for Residential Properties pursuant to 35 IAC 742 Appendix B Table A, the excavated soil can be utilized within the right-of-way or managed and disposed of off-site as “uncontaminated soil” according to Article 202.03. However the excavated soil cannot be taken to a CCDD facility or an uncontaminated soil fill operation.

- (d) Groundwater. When groundwater analytical results indicate the detected levels are above Appendix B, Table E of 35 Illinois Administrative Code 742, the most stringent Tier 1 Groundwater Remediation Objectives for Groundwater Component of the Groundwater Ingestion Route for Class 1 groundwater, the groundwater shall be managed off-site as a special waste.

All groundwater encountered within lateral trenches may be managed within the trench and allowed to infiltrate back into the ground. If the groundwater cannot be managed within the trench it must be removed as a special or hazardous waste. The Contractor is prohibited from managing groundwater within the trench by discharging it through any existing or new storm sewer. The Contractor shall install backfill plugs within the area of groundwater contamination.

One backfill plug shall be placed down gradient to the area of groundwater contamination. Backfill plugs shall be installed at intervals not to exceed 50 ft (15 m). Backfill plugs are to be 4 ft (1.2 m) long, measured parallel to the trench, full trench width and depth. Backfill plugs shall not have any fine aggregate bedding or backfill, but shall be entirely cohesive soil or any class of concrete. The Contractor shall provide test data that the material has a permeability of less than 10⁻⁷ cm/sec according to ASTM D 5084, Method A or per another test method approved by the Engineer.”

Revise Article 669.14 of the Standard Specifications to read:

“669.14 Final Environmental Construction Report. At the end of the project, the Contractor will prepare and submit three copies of the Environmental Construction Report on the activities conducted during the life of the project, one copy shall be submitted to the Resident Engineer, one copy shall be submitted to the District's Environmental Studies Unit, and one copy shall be submitted with an electronic copy in Adode.pdf format to the Geologic and Waste Assessment Unit, Bureau of Design and Environment, IDOT, 2300 South Dirksen Parkway, Springfield, Illinois 62764. The technical report shall include all pertinent information regarding the project including, but not limited to:

- (a) Measures taken to identify, monitor, handle, and dispose of soil or groundwater containing regulated substances, to prevent further migration of regulated substances, and to protect workers,
- (b) Cost of identifying, monitoring, handling, and disposing of soil or groundwater containing regulated substances, the cost of preventing further migration of regulated substances, and the cost for worker protection from the regulated substances. All cost should be in the format of the contract pay items listed in the contract plans (identified by the preliminary environmental site assessment (PESA) site number),
- (c) Plan sheets showing the areas containing the regulated substances,
- (d) Field sampling and testing results used to identify the nature and extent of the regulated substances,

- (e) Waste manifests (identified by the preliminary environmental site assessment (PESA) site number) for special or hazardous waste disposal, and
- (f) Landfill tickets (identified by the preliminary environmental site assessment (PESA) site number) for non-special waste disposal.”

Revise the second paragraph of Article 669.16 of the Standard Specifications to read:

“The transportation and disposal of soil and other materials from an excavation determined to be contaminated will be paid for at the contract unit price per cubic yard (cubic meter) for NON-SPECIAL WASTE DISPOSAL, SPECIAL WASTE DISPOSAL, or HAZARDOUS WASTE DISPOSAL.”

Qualifications. The term environmental firm shall mean an environmental firm with at least five (5) documented leaking underground storage tank (LUST) cleanups or that is pre-qualified in hazardous waste by the Department. Documentation includes but not limited to verifying remediation and special waste operations for sites contaminated with gasoline, diesel, or waste oil in accordance with all Federal, State, or local regulatory requirements and shall be provided to the Engineer for approval. The environmental firm selected shall not be a former or current consultant or have any ties with any of the properties contained within and/or adjacent to this construction project.

General. This Special Provision will likely require the Contractor to subcontract for the execution of certain activities.

All contaminated materials shall be managed as either “uncontaminated soil” or non-special waste. This work shall include monitoring and potential sampling, analytical testing, and management of a material contaminated by regulated substances. The Environmental Firm shall continuously monitor all soil excavation for worker protection and soil contamination. **Phase I Preliminary Engineering information is available through the District’s Environmental Studies Unit.** Soil samples or analysis without the approval of the Engineer will be at no additional cost to the Department. The lateral distance is measured from centerline and the farthest distance is the offset distance or construction limit whichever is less.

The Contractor shall manage any excavated soils and sediment within the following areas:

- Station 3700+00 to Station 3701+00 0 to 100 feet RT (UIC Harrison Field, PESA Site 2515-225, 800 Block of South Harrison Street). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Benzo(k)Fluoranthene, Carbazole, Dibenzo(a,h)Anthracene, Indeno(1,2,3-cd)Pyrene, Naphthalene, and Lead.
- Station 3706+00 to Station 3707+00 0 to 70 feet RT (Downtown Cleaners and Olshaw’s Interior Service, PESA Site 2515-210, 407 South Peoria Street). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Carbazole, Dibenzo(a,h)Anthracene, Indeno(1,2,3-cd)Pyrene, and Lead.

- Station 3701+00 to Station 3703+00 0 to 70 feet RT (UIC Harrison Field, PESA Site 2515-225, 800 Block of South Harrison Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Dibenzo(a,h)Anthracene, and Lead.
- Station 3700+00 to Station 3703+00 0 to 100 feet LT (UIC Parking Lot #9, PESA Site 2515-224, 521 South Morgan Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Dibenzo(a,h)Anthracene, Iron, and Lead.
- Station 3704+75 to Station 3707+00 0 to 70 feet RT (Mixed-Use Building, PESA Site 2515-211, 833-843 West Van Buren Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Pyrene, Lead, Manganese.
- Station 3704+75 to Station 3707+00 0 to 70 feet LT (UIC, PESA Site 2515-209, 400-412 South Peoria Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Pyrene, Lead, and Manganese.

EXPOSED RACEWAYS

Effective: January 1, 2012

Revise the first paragraph of Article 811.03(a) of the Standard Specifications to read:

“General. Rigid metal conduit installation shall be according to Article 810.05(a). Conduits terminating in junction and pull boxes shall be terminated with insulated and gasketed watertight threaded NEMA 4X conduit hubs. The hubs shall be Listed under UL 514B. The insulated throat shall be rated up to 105° C. When PVC coated conduit is utilized, the aforementioned hubs shall also be PVC coated.”

Add the following to Article 811.03(b) of the Standard Specifications:

“Where PVC coated conduit is utilized, all conduit fittings, couplings and clamps shall be PVC coated. All other mounting hardware and appurtenances shall be stainless steel.”

“The personnel installing the PVC coated conduit must be trained and certified by the PVC coated conduit Manufacturer or Manufacturer’s representative to install PVC coated conduit. Documentation demonstrating this requirement must be submitted for review and approval.”

Add the following to Article 1088.01(a) of the Standard Specifications:

All iron and steel products, which are to be incorporated into the work, including conduit and all conduit fittings, shall be domestically manufactured or produced and fabricated as specified in Article 106.”

Revise Article 1088.01(a)(3) of the Standard Specifications to read:

“a. PVC Coated Steel Conduit. The PVC coated rigid metal conduit shall be UL Listed (UL 6). The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations shall be UL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating shall be UL listed.

b. The PVC coating shall have the following characteristics:

Hardness:	85+ Shore A Durometer
Dielectric Strength:	400V/mil @ 60 Hz
Aging:	1,000 Hours Atlas Weatherometer
Temperature	The PVC compound shall conform at 0° F. to Federal Specifications PL-406b, Method 2051, Amendment 1 of 25 September 1952 (ASTM D 746)
Elongation:	200%

c. The exterior and interior galvanized conduit surface shall be chemically treated to enhance PVC coating adhesion and shall also be coated with a primer before the PVC coating to ensure a bond between the zinc substrate and the PVC coating. The bond strength created shall be greater than the tensile strength of the plastic coating.

d. The nominal thickness of the PVC coating shall be 1 mm (40 mils). The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above -1°C (30°F).

e. An interior urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. The interior coating shall be applied in a manner so there are no runs, drips, or pinholes at any point. The coating shall not peel, flake, or chip off after a cut is made in the conduit or a scratch is made in the coating.

- f. Conduit bodies shall have a tongue-in-groove gasket for maximum sealing capability. The design shall incorporate a positive placement feature to assure proper installation. Certified test results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be submitted for review when requested by the Engineer.
- g. The PVC conduit shall pass the following tests:

Exterior PVC Bond test RN1:

Two parallel cuts 13 mm (1/2 inch) apart and 40 mm (1 1/2 inches) in length shall be made with a sharp knife along the longitudinal axis. A third cut shall be made perpendicular to and crossing the longitudinal cuts at one end. The knife shall then be worked under the PVC coating for 13 mm (1/2 inch) to free the coating from the metal.

Using pliers, the freed PVC tab shall be pulled with a force applied vertically and away from the conduit. The PVC tab shall tear rather than cause any additional PVC coating to separate from the substrate.

Boil Test:

Acceptable conduit coating bonds (exterior and interior) shall be confirmed if there is no disbondment after a minimum average of 200 hours in boiling water or exposure to steam vapor at one atmosphere. Certified test results from a national recognized independent testing laboratory shall be submitted for review and approval. The RN1 Bond Test and the Standard Method for Measuring Adhesion by Tape Test shall be utilized.

Exterior Adhesion. In accordance with ASTM D870, a 6" length of conduit test specimen shall be placed in boiling water. The specimen shall be periodically removed, cooled to ambient temperature and immediately tested according to the bond test (RN1). When the PVC coating separates from the substrate, the boil time to failure in hours shall be recorded.

Interior Adhesion. In accordance with ASTM D3359, a 6" conduit test specimen shall be cut in half longitudinally and placed in boiling water or directly above boiling water with the urethane surface facing down. The specimen shall be periodically removed, cooled to ambient temperature and tested in accordance with the Standard Method of Adhesion by Tape Test (ASTM D3359). When the coating disbonds, the time to failure in hours shall be recorded.

Heat/Humidity Test:

Acceptable conduit coating bonds shall be confirmed by a minimum average of 30 days in the Heat and Humidity Test. The RN1 Bond Test and the Standard Method for Measuring Adhesion by Tape Test shall be utilized.

Exterior Adhesion. In accordance with ASTM D1151, D1735, D2247 and D4585, conduit specimens shall be placed in a heat and humidity environment where the temperature is maintained at 150°F (66°C) and 95% relative humidity. The specimens shall be periodically removed and a bond test (RN1) performed. When the PVC coating separates from the substrate, the exposure time to failure in days shall be recorded.

Interior Adhesion. In accordance with ASTM D3359, conduit specimens shall be placed in a heat and humidity environment where the temperature is maintained at 150°F (66°C) and 95% relative humidity. When the coating disbonds, the time to failure in hours shall be recorded.

Add the following to Article 1088.01(a)(4) of the Standard Specifications:

“All liquid tight flexible metal conduit fittings shall have an insulated throat to prevent abrasion of the conductors and shall have a captive sealing O-ring gasket. The fittings shall be Listed under UL 514B. The insulated throat shall be rated up to 105° C.”

Revise the second paragraph of Article 811.04 of the Standard Specifications to read:

“Expansion fittings and LFNC will not be measured for payment.”

Revise Article 811.05 of the Standard Specifications to read:

“811.05 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for **CONDUIT ATTACHED TO STRUCTURE**, of the diameter specified, **RIGID GALVANIZED STEEL** or **CONDUIT ATTACHED TO STRUCTURE**, of the diameter specified, **PVC COATED GALVANIZED STEEL.**”

UNDERPASS LUMINAIRE, HPS, STAINLESS STEEL HOUSING

Effective: January 1, 2012

Description. This item shall consist of furnishing, testing as required, and installing a luminaire suitable for roadway underpasses as specified herein.

General. The luminaire shall be optically sealed, mechanically strong and easy to maintain.

All wiring within the fixture shall have a minimum temperature rating of 125° C. In addition, the unit shall be designed to allow for a maximum supply wire rating of 90° C.

All hardware of the housing, reflector, and ballast assembly shall be captive.

The luminaire shall be UL Listed for Wet Locations.

The underpass luminaire shall be suitable for lighting a roadway underpass at approximate mounting height of 16 feet from a position suspended directly above the roadway.

The luminaire shall be certified by the U.L. testing laboratory to meet the IP66 criteria of the International Electro technical Commission Standard 529.

Housing. The housing shall be stainless steel and be made of 16 gauge minimum thickness stainless steel, Type 304, #2B finish.

Since the installed location of the luminaires has severe space limitations that prohibit servicing the luminaire from the top or side of the fixture, the luminaire must be serviceable from the bottom of the housing when in the installed position. Both ballast and optical compartments must be serviceable from the bottom of the fixture. Fixtures which open from the top or sides are not acceptable.

The housing shall have a maximum width of 13”

All internal and external hardware, unless specifically specified otherwise, shall be made of stainless steel.

Stainless Steel Housing

The stainless steel housing, and lens frame shall be made of 16 gauge minimum thickness stainless steel, Type 304 #2B.

All housing and frame components shall be cut within with a laser with a positioning accuracy of +/- .004” for assembly accuracy and machine welded to minimize irregularities in the weld joint.

All seams in the housing enclosure shall be welded by continuous welding. Stainless steel weld wire shall be used for all welds. A sample weld shall be submitted for review and approval.

The luminaire lens shall be flush, within 3.1 mm (0.122"), of the lens frame.

The lens frame shall be flat and the frame and luminaire housing shall not have any protruding flanges.

The lens frame assembly shall consist of a one-piece 16 gauge 304 stainless steel external frame with the lens facing toward the housing and a 16 gauge 304 stainless internal frame with the legs facing away from the housing. The internal frame shall have seam welded corners for added strength. The two panels will sandwich the glass lens and be fastened together with the use of no less than 10 #10 stainless steel fasteners.

The lens frame and the door frame shall each be secured through the use of two stainless steel draw latches secured to the fixture housing.

When in open position, it shall be possible to un-hinge and remove the lens frame for maintenance. The lens frame hinge shall be stainless steel and designed so that there must be a conscious action of the maintenance personnel to remove the lens frame. The frame hinging method shall not be designed so that bumping the frame accidentally could allow the frame to fall to the roadway surface. The removal method must be accomplished without the use of tools or hardware. The hinge pin shall be a minimum of 6.35 mm (0.250") in diameter. The pin shall be spring loaded and retractable with a safety catch to hold the pin in the retracted position for ease of maintenance.

The suspended housing shall be divided into two compartments, one for the ballast and optical assembly, the other for wire connections. The optical chamber shall be sealed from the environment. The wire portal between compartments shall be sealed so as to prevent air exchange through the portal. There shall be an internally mounted breather mechanism to allow internal and external air pressure to equalize without permitting dust or water into the unit.

The ballast and all electrical equipment shall be mounted to a removable aluminum chassis with a minimum thickness of 3.175, (0.125"). The chassis shall be held in place with captive stainless steel hardware. The hardware shall include a bracket that can be loosened and shifted to allow the chassis to pivot away from fastened position for removal. The splice box shall include a heavy-duty 3 pole terminal block to accommodate #6 conductors and a KTK 2 amp fuse with HPC fuse holder or approved equal. Quick-connect power distribution terminal blocks shall be a molded thermoset plastic, rated 70A, 600V and have 3 poles, each with (4) .250 quick connect terminals. Operating temperature rating to be 150° C. Input wire size shall accommodate #2-#14 AWG. Torque rating shall be 45 in./lb. Maximum. Agency approvals shall be UL E62622; CSA LR15364.

Ballast compartment surfaces shall be deburred and free of sharp edges, points or corners that may come in contact with installers or service personnel.

Gasketing. The junction between the lens frame and the ballast housing door and the housing shall be sealed with a one-piece vulcanized or molded high temperature solid silicone rubber gasket with the equivalent of a 60 Shore A durometer rating. The gasket between the lens frame and the luminaire housing shall be securely attached by mechanical means, such a retaining lip to prevent the movement of the gasket. The gasket may not be secured by adhesive means exclusively. The lens and ballast housing doors shall be designed and constructed so they seal to the gasket on a flat surface. The frame shall not seal to the gasket using the edge of leg on a doorframe. The lens shall be sealed inside of the lens frame with the use of a one-piece solid silicone rubber gasket with ribbed flanges and a rating of 60 Shore A Durometer

The junction between conduit connections to the luminaire and the lens frame junction to the housing shall withstand entry of water when subjected to a water jet pressure of 207 kPa (30 lbs. Per sq. inch), tested under laboratory conditions. Submittal information shall include data relative to gasket thickness and density and the means of securing it in place.

Mounting Brackets. The brackets shall be properly sized to accommodate the weight of the luminaire with calculations or other suitable reference documentation submitted to support the material choice.

The luminaire shall have an opening in the housing for installation (by others) of a 28.1 mm (3/4 inch) diameter flexible conduit. The location of the opening will be determined by the Engineer during the shop drawing review.

Lamp Socket. The lamp socket shall be a 4KV pulse rated mogul type, porcelain glazed enclosed, and be provided with grips, or other suitable means to hold the lamp against vibration. The rating of the socket shall exceed the lamp starting voltage, or starting pulse voltage rating.

If the lamp socket is of the sealed removable type, proper alignment of the socket shall be provided and molded into the socket assembly and indicated in a contrasting color.

If the lamp socket is adjustable, the factory setting must be indicated legibly in the luminaire housing.

ANSI Identification Decal. A decal, complying to ANSI standard C136-15 for luminaire wattage and distribution type, shall be factory attached permanently to the luminaire. The information contained in the decal shall enable a viewer, from the ground level, to identify the lamp wattage and type of luminaire distribution.

Optical Assembly. Lens and Lens Frame. The lens shall be made of crystal clear, impact and heat resistant tempered glass a minimum of 6.35 mm (0.25") thick. The lens shall be held in such a manner as to allow for its expansion and contraction, due to temperature variation. The lens shall be a flat glass design.

Reflector. The reflector shall be hydro formed aluminum, 0.063" thick, bright-dip and clear anodized finish.

The reflector shall be secured with a stainless steel aircraft cable during maintenance operations.

If the reflector has multiple light distribution positions, each position must have positive stop/mounting with the original factory distribution identified.

The luminaire shall be photometrically efficient. Luminaire efficiency, defined by the I.E.S. as "the ratio or luminous flux (lumens) emitted by a luminaire to that emitted by the lamp or lamps used within", shall not be less than 67%. Submittal information shall include published efficiency data.

The reflector, the refractor or lens, and the entire optical assembly shall not develop any discoloration over the normal life span of the luminaire.

The reflector shall not be altered by paint or other opaque coatings which would cover or coat the reflecting surface. Control of the light distribution by any method other than the reflecting material and the aforementioned clear protective coating that will alter the reflective properties of the reflecting surface is unacceptable

Ballast. The ballast shall be a High Pressure Sodium, high power factor, lead type, Isolated Regulator Ballast (CWI) or a Constant Wattage Auto-regulator (CWA), for operation on a nominal 240 volt system.

The ballast shall be designed to furnish proper electrical characteristics for starting and operating a high pressure sodium vapor lamp of the specified rating at ambient temperatures of -29 degrees to +40 degrees C. The ballast windings shall be adequately impregnated and treated for protection against the entrance of moisture, insulated with Class H insulation, and able to withstand the NEMA standard dielectric test.

The ballast shall include an electronic starting assembly. The starter assembly shall be comprised of solid state devices capable of withstanding ambient temperatures of 85 degrees C. The starter shall provide timed pulsing with sufficient follow-through current to completely ionize and start all lamps. Minimum amplitude of the pulse shall be 2,500 volts, with a width of one (1) microsecond at 2,250 volts, and shall be applied within 20 electrical degrees of the peak of the open circuit voltage wave with a repetition rate as recommended by the lamp manufacturer for the 60 cycle wave. The lamp peak pulse current shall be a minimum of 0.2 amperes. Proper ignition shall be provided over a range of input voltage from 216 to 264 volts. The starter component shall be field replaceable and completely interchangeable with no adjustment necessary for proper operation. The starter component shall have push-on type electrical terminations to provide good electrical and mechanical integrity and ease of replacement. Terminal configuration shall preclude improper insertion of plug-in components. The starter circuit board shall be treated in an approved manner to provide a water and contaminant-resistant coating.

The ballast shall have an overall power factor of at least 0.9 when operated under rated lamp load.

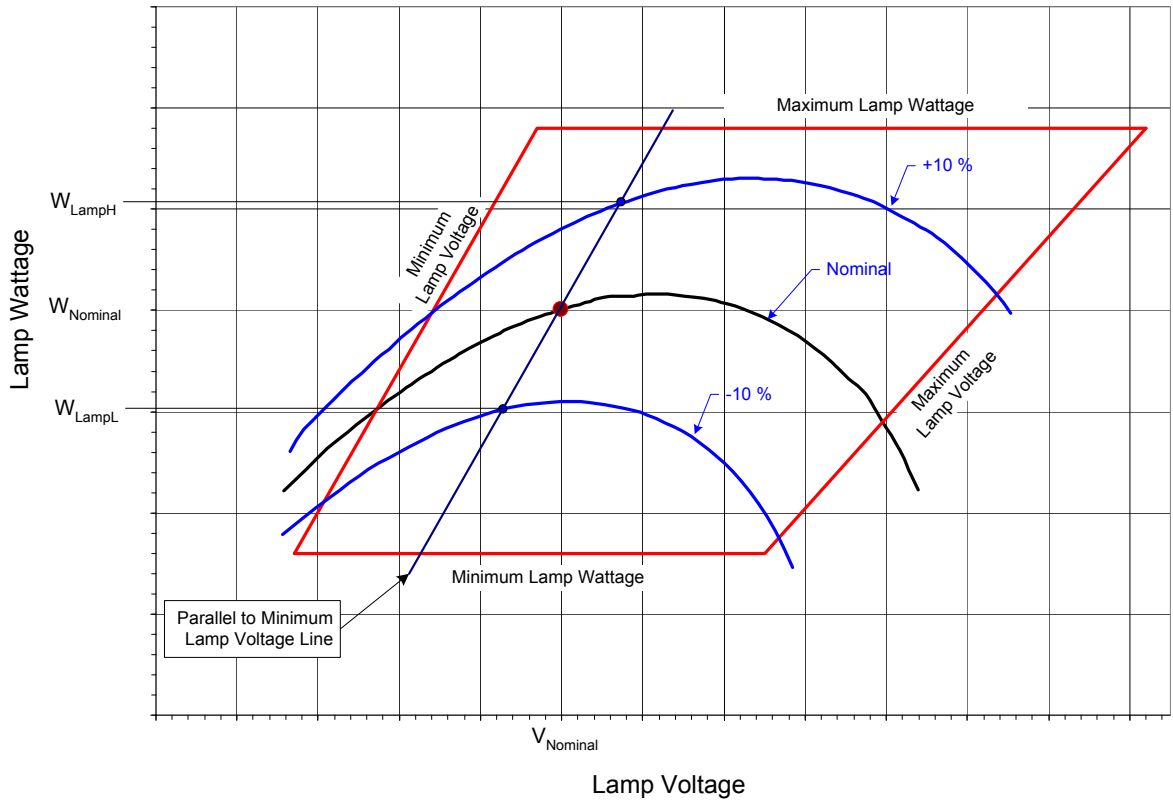
The ballast shall withstand a 2,500 volt dielectric test between the core and windings without damage to the insulation.

The ballast shall not subject the lamp to a crest factor exceeding 1.8 and shall operate the lamp without affecting adversely the lamp life and performance.

The ballast shall be designed to ANSI Standards and shall be designed and rated for operation on a nominal 240 volt system. The ballast shall provide positive lamp ignition at the input voltage of 216 volts. It shall operate the lamp over a range of input voltages from 216 to 264 volts without damage to the ballast. It shall provide lamp operation within lamp specifications for rated lamp life at input design voltage range. Operating characteristics shall produce output regulation not exceeding the following values:

Nominal Ballast Wattage	Maximum Ballast Regulation
400	25%
310	26%
250	22%
150	22%
70	17%

For this measure, regulation shall be defined as the ratio of the lamp watt difference between the upper and lower operating curves to the nominal lamp watts; with the lamp watt difference taken within the ANSI trapezoid at the nominal lamp operating voltage point parallel to the minimum lamp volt line:



$$\text{Ballast Regulation} = \frac{W_{LampH} - W_{LampL}}{W_{LampN}} \times 100$$

where:

W_{LampH} = lamp watts at +10% line voltage (264v)

W_{LampL} = lamp watts at - 10% line voltage (216v)

W_{lampN} = lamp watts at 240v"

Ballast losses, based on cold bench tests, shall not exceed the following values:

Nominal Ballast Wattage	Maximum Ballast Losses
400	16.0%
310	19.0%
250	17.5%
150	26.0%
70	34.0%

Ballast losses shall be calculated based on input watts and lamp watts at nominal system voltage as indicated in the following equation:

$$\text{Ballast Losses} = \frac{W_{Line} - W_{Lamp}}{W_{Lamp}} \times 100$$

where:

W_{line} = line watts at 240v

W_{lamp} = lamp watts at 240v

Ballast output to lamp. At nominal system voltage and a lamp voltage of 52v, the ballast shall deliver a lamp wattage within $\pm 4\%$ of the nominal lamp wattage. For a 70w luminaire, the ballast shall deliver 70 watts $\pm 4\%$ at a lamp voltage of 52v for the nominal system voltage of 240v.

Ballast output over lamp life. Over the life of the lamp the ballast shall produce an average of the nominal lamp rating $\pm 5\%$. Lamp wattage readings shall be taken at 5-volt increments throughout the ballast trapezoid. The lamp wattage values shall then be averaged within the trapezoid and shall be within $\pm 5\%$ of the nominal ballast rating. Submittal documents shall include a tabulation of the lamp wattage vs. lamp voltage readings.

The ballast shall be integral to the luminaire. The ballast components shall be mounted on a removable door or on a removable mounting tray. The ballast tray or mounting door shall be manufactured with dissimilar metal conflicts kept to a minimum.

Ballast wiring and lamp socket wiring shall be connected by means of keyed plugs. Upon unplugging the ballast wiring the entire ballast assembly shall be removable for maintenance. The plugs shall not be interchangeable to avoid improper connection of the assemblies.

The mounting adjustments and wiring terminals shall be readily accessible. The removable door or pad shall be secure when fastened in place and all individual components shall be secure upon the removable element. Upon ballast assembly removal, each component shall be readily removable for replacement.

The luminaire shall be completely wired. All wiring connections within the luminaire shall be made with insulated compression connectors or insulated terminal blocks. An insulated terminal block shall be provided to terminate the incoming supply wires. The terminal block shall be rated for 600 volts and shall accommodate wire sizes from #10 to #6 AWG. The use of "wire nuts" is unacceptable. A ground terminal shall be provided for the connection of a ground wire.

Ballast and lamp Leads shall not be smaller than #16 AWG conductors rated at a minimum temperature rating of 90° C.

All wires shall be coded by tagging and/or color coding for proper identification. A complete legible permanently attached wiring diagram (no smaller than 3" x 4" with a min. font size of 8 pts.) coordinated with the wire identifications shall be displayed at the convenient location on the interior of the luminaire. The wiring diagram shall be oriented so that it is right side up and readable when the luminaire is in the installed position.

The ballast shall not be excessively noisy. Noticeable noisy ballasts, as determined by the Engineer, shall be replaced at no additional cost to the State.

The ballast shall provide lamp operation within lamp specifications for the rated lamp life at the input design voltage range. It shall have a 6 month operation capability with a cycling lamp.

Submittal information shall include manufacturer's literature and data to confirm compliance with all specified requirements including an ANSI Standard Ballast Characteristic Graph (Trapezoid) diagram, with all items clearly identified.

Photometric Performance. The luminaire photometric performance shall produce results equal to or better than those listed in the included Luminaire Performance Table. Submittal information shall include computer calculations based on the controlling given conditions which demonstrate achievement of all listed performance requirements. The computer calculations shall be done according to I.E.S. recommendations and the submitted calculations shall include point-by-point illuminance, luminance and veiling luminance as well as listings of all indicated averages and ratios as applicable. Calculations shall be performed with AGI32. The program used to perform the calculations shall be identified on the submittal. The submittal data shall also include all photometric calculations files with the proposed photometric data on a CD ROM. The performance requirements shall define the minimum number of decimal places used in the calculations. Rounding of calculations shall not be allowed.

In addition to computer printouts of photometric performance, submittal information shall include: Descriptive literature; an Isofootcandle chart of horizontal lux (footcandles); Utilization curve; Isocandela diagram; Luminaire classification per ANSI designation; Candlepower values at every 2.5 degree intervals; Candlepower tables are to be provided on CD ROM in the IES format as specified in IES publication LM-63.

**IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE #1
 5 Lane Cross Section**

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	<u>60 ft</u>
	Number of Lanes	<u>5</u>
	I.E.S. Surface Classification	<u>R3</u>
	Q-Zero Value	<u>.07</u>
LIGHT POLE DATA	Mounting Height	<u>16 ft</u>
	Mast Arm Length	<u>0 ft</u>
	Pole Set-Back From Edge of Pavement	<u>2 ft</u>
LUMINAIRE DATA	Lamp Type	<u>HPS</u>
	Lamp Lumens	<u>9,500</u>
	I.E.S. Vertical Distribution	<u>Medium</u>
	I.E.S. Control Of Distribution	<u>Cutoff</u>
	I.E.S. Lateral Distribution	<u>IV</u>
	Total Light Loss Factor	<u>0.65</u>
LAYOUT DATA	Spacing	<u>35 ft</u>
	Configuration	<u>Opposite Side</u>
	Luminaire Overhang over edge of pavement	<u>-2 ft</u>

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS		
---------------------------------	--	--

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ILLUMINATION	Ave. Horizontal Illumination, E_{AVE}	<u>18 Lux</u>
	Uniformity Ratio, E_{AVE}/E_{MIN}	<u>2.5:1</u>
LUMINANCE	Average Luminance, L_{AVE}	<u>1.2 Cd/m²</u>
	Uniformity Ratio, L_{AVE}/L_{MIN}	<u>2.5:1 (Max)</u>
	Uniformity Ratio, L_{MAX}/L_{MIN}	<u>4:1 (Max)</u>
	Veiling Luminance Ratio, L_V/L_{AVE}	<u>0.25:1 (Max)</u>

**IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE #2
 4 Lane Cross Section**

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	48 ft
	Number of Lanes	4
	I.E.S. Surface Classification	R3
	Q-Zero Value	.07
LIGHT POLE DATA	Mounting Height	16 ft
	Mast Arm Length	0 ft
	Pole Set-Back From Edge of Pavement	2 ft
LUMINAIRE DATA	Lamp Type	HPS
	Lamp Lumens	9,500
	I.E.S. Vertical Distribution	Medium
	I.E.S. Control Of Distribution	Cutoff
	I.E.S. Lateral Distribution	IV
	Total Light Loss Factor	0.65
LAYOUT DATA	Spacing	35 ft
	Configuration	Opposite Side
	Luminaire Overhang over edge of pavement	-2 ft

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS		
--------------------------	--	--

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ILLUMINATION	Ave. Horizontal Illumination, E_{AVE}	18 Lux
	Uniformity Ratio, E_{AVE}/E_{MIN}	2.5:1
LUMINANCE	Average Luminance, L_{AVE}	1.2 Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	2.5:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	4:1
	Veiling Luminance Ratio, L_V/L_{AVE}	0.25:1

**IDOT DISTRICT 1 LUMINAIRE PERFORMANCE TABLE #3
 3 Lane Cross Section**

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	36 ft
	Number of Lanes	3
	I.E.S. Surface Classification	R3
	Q-Zero Value	.07
LIGHT POLE DATA	Mounting Height	16 ft
	Mast Arm Length	0 ft
	Pole Set-Back From Edge of Pavement	2 ft
LUMINAIRE DATA	Lamp Type	HPS
	Lamp Lumens	6,300
	I.E.S. Vertical Distribution	Medium
	I.E.S. Control Of Distribution	Cutoff
	I.E.S. Lateral Distribution	III
	Total Light Loss Factor	0.65
LAYOUT DATA	Spacing	45 ft
	Configuration	Opposite Side
	Luminaire Overhang over edge of pavement	-2 ft

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

PERFORMANCE REQUIREMENTS		
--------------------------	--	--

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ILLUMINATION	Ave. Horizontal Illumination, E_{AVE}	18 Lux
	Uniformity Ratio, E_{AVE}/E_{MIN}	2.5:1
LUMINANCE	Average Luminance, L_{AVE}	1.2 Cd/m ²
	Uniformity Ratio, L_{AVE}/L_{MIN}	2.5:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	4:1
	Veiling Luminance Ratio, L_V/L_{AVE}	0.30:1

Independent Testing. Independent testing of luminaires shall be required whenever the quantity of luminaires of a given wattage and distribution, as indicated on the plans, is 50 or more. For each luminaire type to be so tested, one luminaire plus one luminaire for each 50 luminaires shall be tested. Example: *A plan quantity of 75 luminaires would dictate that 2 to be tested; 135 luminaires would dictate that three be tested.*

The Contractor shall be responsible for all costs associated with the specified testing, including but not limited to shipping, travel and lodging costs as well as the costs of the tests themselves, all as part of the bid unit price for this item. Travel, lodging and other associated costs for travel by the Engineer shall be direct-billed to or shall be pre-paid by the Contractor, requiring no direct reimbursement to the Engineer or the independent witness, as applicable.

Commitment to test. The Vendor shall select one of the following options for the required testing with the Engineer's approval:

Engineer Factory Selection for Independent Lab: The Contractor may select this option if the luminaire manufacturing facility is within the state of Illinois. The Contractor shall propose an independent test laboratory for approval by the Engineer. The selected luminaires shall be marked by the Engineer and shipped to the independent laboratory for tests.

Engineer Witness of Independent Lab Test: The Contractor may select this option if the independent testing laboratory is within the state of Illinois. The Engineer shall select, from the project luminaires at the manufacturer's facility or at the Contractor's storage facility, luminaires for testing by the independent laboratory.

Independent Witness of Manufacturer Testing: The independent witness shall select from the project luminaires at the manufacturer's facility or at the Contractor's storage facility, the luminaires for testing. The Contractor shall propose a qualified independent agent, familiar with the luminaire requirements and test procedures, for approval by the Engineer, to witness the required tests as performed by the luminaire manufacturer. The independent witness shall:

- ▶ Have been involved with roadway lighting design for at least 15 years.
- ▶ Not have been the employee of a luminaire or ballast manufacturer within the last 5 years.
- ▶ Be a member of IESNA in good standing.
- ▶ Provide a list of professional references.

Engineer Factory Selection and Witness of Manufacturer Testing: The Contractor may select this option if the manufacturing facility is within the state of Illinois. At the manufacturer's facility, the Engineer shall select the luminaires to be tested and shall be present during the testing process. The Contractor shall schedule travel by the Engineer to and from the Manufacturer's laboratory to witness the performance of the required tests.

In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. The selection of the testing option shall be presented with the information submitted for approval. The proposed independent laboratory or independent witness shall be included with that information. The selection of the testing option shall be presented with the information submitted for approval. The proposed independent laboratory or independent witness shall be included with that information.

The testing performed shall include photometric, electrical, heat and water jet testing.

Photometric testing shall be in accordance with IES recommendations except that the selected luminaire(s) shall be tested as manufactured without any disassembly or modification and, as a minimum shall yield an isofootcandle chart, with max candela point and half candela trace indicated, an isocandela diagram, maximum plane and cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, and complete calculations based on specified requirements and tests.

Electrical testing shall conform to NEMA and ANSI standards and as a minimum, shall yield a complete check of wiring connections, a ballast dielectric test, total ballast losses in watts and percent of input, a lamp volt-watt trace, regulation data, a starter test, lamp current crest factor, power factor (minimum over the design range of input voltage at nominal lamp voltage) and, a table of ballast characteristics showing input amperes, watts and power factor, output volts, amperes, watts and lamp crest factor as well as ballast losses over the range of values required to produce the lamp volt-watt trace. Ballast test data shall also be provided in an electronic format acceptable to the Engineer to demonstrate compliance with sections 9.7, 9.8, 9.9 and 9.10.

Heat Testing. Heat testing shall be conducted to ensure that the luminaire complies with UL 1572. An ambient temperature of 40 degrees centigrade (104 degrees F) shall be used for the test.

Water spray test. The luminaires must pass the following water spray test.:

A spray apparatus consisting of four spray nozzles set at an angle of 30 degrees from the vertical plane space 30 inches apart on a 2 inch pipe, each delivering 12 gallons of water per minute at a minimum of 100 psi at each nozzle in a 90 degree cone. A water pressure gauge shall be installed at the first nozzle.

The luminaires shall be mounted in a ceiling configuration and with each nozzle set a distance of 18 inches below the fixture in the vertical plane and 18 inches away in the horizontal plane from the fixture lens, apply spray for a duration of 3 minutes at a minimum of 100 psi. When opened, the fixture shall not show any signs of leakage.

The above test shall be repeated in the opposite horizontal plane from the fixture lens with no signs of leakage.

The summary report and the test results shall be certified by the independent test laboratory or the independent witness, as applicable, and shall be sent by certified mail directly to the Engineer. A copy of this material shall be sent to the Contractor and luminaire manufacturer at the same time.

Should any of the tested luminaires of a given distribution type and wattage fail to satisfy the specifications and perform according to approved submittal information, the luminaire of that distribution type and wattage shall be unacceptable and be replaced by alternate equipment meeting the specifications with the submittal and testing process repeated in their entirety; or corrections made to achieve required performance. In the case of corrections, the Vendor shall advise the Engineer of corrections made and shall request a repeat of the specified testing and, if the corrections are deemed reasonable by the Engineer, the testing process shall be repeated. The number of luminaires to be tested shall be the same quantity as originally tested. Luminaires which are not modified or corrected shall not be re-tested without prior approval from the Engineer.

Coordination shall be the Vendor's responsibility. Failure to coordinate arrangements and notice shall not be grounds for additional compensation or extension of time.

Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen laboratory.

Installation. Underpass luminaires shall be either attached to structures (such as piers, etc.) or suspended from structures (such as bridge decks) as indicated or implied by the configuration on the Plans. Mounting, including all hardware and appurent items, shall be included as part of this item.

Unless otherwise indicated, suspended underpass luminaires shall be installed one-inch above the lowest underpass beam and shall be mounted using vibration dampening assemblies. All mounting hardware shall be corrosion resistant and shall be stainless steel unless otherwise indicated.

The Engineer reserves the right to select the final light distribution pattern, luminaire aiming angle and change it as deemed necessary to produce the proper pavement luminance.

Surface mounted luminaires, all luminaires not mounted on suspension rods, shall have one-inch thick stainless steel spacers installed between the luminaire and the deck or wall.

Guarantee. The Vendor shall provide a written guarantee for materials, and workmanship for a period of 6 months after final acceptable of the lighting system.

Documentation. All instruction sheets required to be furnished by the manufacturer for materials and supplies and for operation of the equipment shall be delivered to the Engineer.

The manufacturer shall have been incorporated for at least five years and shall have at least five years in the design and manufacturing of roadway underpass lighting. The manufacturer shall provide evidence of financial strength to finance the production of the project by submitting the name of at least three projects completed in the previous calendar year of greater than \$250,000 each. All steel used in the project shall be certified to be provided domestically, and all fixture components used shall be manufactured domestically.

Method of Measurement. Luminaires shall be counted, each.

Basis of Payment. This item shall be paid at the contract unit price each for UNDERPASS LUMINAIRE, of the wattage specified, HIGH PRESSURE SODIUM VAPOR, which shall be payment in full for the material and work described herein.

REMOVAL OF LIGHTING UNIT, SALVAGE

Add the following to Article 842.03(b) of the Standard Specifications:

Removal of City of Chicago Lighting Unit, Salvage. Where indicated, poles, mast arms, luminaires, ballast housing and all associated hardware and appurtenances shall remain the property of the City of Chicago and shall be delivered back to the City. City of Chicago salvaged lighting units must be delivered to the City storage yard located at 4100 South Cicero Avenue, Chicago, IL or to another City of Chicago locations as directed by the Engineer.

Transportation. The Contractor shall crate and transport the light pole, mast arm, luminaire and ballast housing in complete conformance with the manufacturer's recommendations. The Contractor shall make arrangements to transfer the street lighting equipment to the City of Chicago's storage facility located at 4100 South Cicero Avenue, Chicago, IL. This shall be done on weekdays between the hours of 8:00 a.m. and 4:00 p.m., excluding City holidays. Forty-eight hours advance notice is necessary before drop off of street lighting equipment.

REMOVE EXISTING HANDHOLE

Description. Work under this item will include breaking down an existing handhole or manhole and filling in the affected area to grade. This item includes the complete removal of all City of Chicago manhole or handhole electrical structures. These structures include roadway lighting, traffic signals, communications or other utilities and may be empty.

Demolition. This work will consist of removing the frame and cover of an existing handhole or manhole, breaking down the handhole/manhole walls, removing large debris, and backfilling the hole with screenings or other approved material. Backfill must be installed in 6 inch layers and tamped. If the handhole/manhole is in a parkway, the hole must be filled level to the existing grade. The top six inches of fill must be of an approved soil mixture. If the handhole/manhole is in sidewalk or in pavement, the sidewalk or pavement must be restored under a different pay item. If the frame or cover is deemed re-useable by the Engineer, the frame and/or cover must be delivered to the CDOT at a location identified by the Engineer. Any debris, including the frame and cover must be disposed of off-sight in an approved manner. The Contractor will pay for all disposal fees.

Method of Measurement. This work will be paid for per each manhole or handhole removed. All backfill will be considered as part of the manhole breakdown.

Basis of Payment. This work will be paid for at the contract unit price per each for REMOVE EXISTING HANDHOLE which price will be payment in full for all labor and materials necessary to complete the work as described. Salvaging of the frame and cover will be considered incidental to this item.

WEED CONTROL, PRE-EMERGENT GRANULAR HERBICIDE

Effective: July 29, 2002

Revised: February 7, 2007

Description: This work shall consist of spreading a pre-emergent granular herbicide in place of weed barrier fabric in areas as shown on the plans or as directed by the Engineer. This item will be used in mulched plant beds and mulch rings.

Delete Article 253.11 and substitute the following:

Within 48 hours after planting, mulch shall be placed around all plants in the entire mulched bed or saucer area specified to a depth of 4 inches (100 mm). No weed barrier fabric will be required for tree and shrub planting. Pre-emergent Herbicide will be used instead of weed barrier fabric. The Pre-emergent Herbicide shall be applied prior to mulching. Mulch shall not be in contact with the base of the trunk.

Materials: The pre-emergent granular herbicide (Snapshot 2.5 TG or equivalent) shall contain the chemicals Trifluralin 2% active ingredient and Isoxaben with 0.5% active ingredient. The herbicide label shall be submitted to the Engineer for approval at least seventy-two (72) hours prior to application.

Method: The pre-emergent granular herbicide shall be used in accordance with the manufacturer's directions on the package. The granules are to be applied prior to mulching.

Apply the granular herbicide using a drop or rotary-type designed to apply granular herbicide or insecticides. Calibrate application equipment to use according to manufacturer's directions. Check frequently to be sure equipment is working properly and distributing granules uniformly. Do not use spreaders that apply material in narrow concentrated bands. Avoid skips or overlaps as poor weed control or crop injury may occur. More uniform application may be achieved by spreading half of the required amount of product over the area and then applying the remaining half in swaths at right angles to the first. Apply the granular herbicide at the rate of 100 lbs/acre (112 kg/ha) or 2.3 lbs/1000 sq. ft. (11.2 kg/1000 sq. meters).

Method of Measurement: Pre-emergent granular herbicide will be measured in place in Pounds (Kilograms) of Pre-emergent Granular Herbicide applied. Areas treated after mulch placement shall not be measured for payment.

Basis of Payment: This work will be paid for at the contract unit price per pound (kilogram) of WEED CONTROL, PRE-EMERGENT GRANULAR HERBICIDE.

MULCH

Description: Work under this item shall be done accordance with the applicable portion of Section 253.02 (c) and Section 1081.06 of the Standard Specifications for Road and Bridge Construction. This work shall consist of furnishing, transporting and spreading approved shredded hardwood bark mulch in areas as shown on the plans or as directed by the Engineer.

Materials: Hardwood bark mulch shall be clean, finely shredded mixed-hardwood bark meeting the following requirements:

- Material shall be free of sticks, leaves, stones, dirt clods, and other debris.
- Individual wood chips shall not exceed 2 inches (50 mm) in the largest dimension.

All hardwood mulch shall be processed through a hammer mill. Hardwood bark not processed through a hammer mill shall not be accepted.

A mulch sample and request for material inspection must be supplied to the Engineer for approval prior to performing any work 72 hours prior to application.

Method: The grade, depth, and condition of the area must be approved by the Engineer prior to placement.

The Contractor shall remove and properly dispose of all weeds, litter and plant debris before mulching. Weed control, pre-emergent granular herbicide shall be applied prior to the placement of shredded mulch.

The shredded mulch shall be placed as specified in the plans. Mulch shall not be in contact with the base of the trunk.

All finished mulch areas shall be left smooth and level to maintain uniform surface and appearance.

After the mulch placement, any debris or piles of material shall be immediately removed from the right of way, including raking excess mulch out.

Method of Measurement: Mulch will be measured in place in cubic yards.

Basis of Payment: This work will be paid for at the contract unit price per cubic yard for MULCH. Payment shall include the cost of removing and disposing of any debris. Weed control, pre-emergent granular herbicide shall be paid for separately.

REMOVE TEMPORARY WOOD POLE

Description. This item consists of removing existing temporary wood poles, aerial cable, and all associated apparatus and connections. This removal shall also include removal of all wiring and connections to the associated lighting controller. All equipment and material removed as part of this item shall become property of the Contractor and shall be removed from the site.

Pole holes shall be backfilled according to Article 819.04.

Method of Measurement. Units measured for payment will be counted on a per-pole basis, regardless of pole material, mounting height, and installation depth.

Basis of Payment. This work will be paid for at the Contract unit price each for REMOVE TEMPORARY WOOD POLE.

PILE EXTRACTION

Description. This item shall consist of furnishing all labor, equipment and materials necessary for the extraction of timber piles at locations shown on the Plans, or as directed by the Engineer, including all pertinent work such as removal and satisfactory disposal of adjacent concrete mats or other obstructions interfering with the removal operations as directed by the Engineer. The work shall be done in accordance with the applicable portions of Section 501 of the Standard Specifications.

The work shall conform in every respect to all environmental, state and local regulations regarding construction requirements, the protection of adjacent properties, as well as dust and noise control.

Prior to commencing work under this Item, the Contractor shall verify the location of all existing utilities in the area. The Contractor shall submit drawings and written documentation to the Engineer of such verification. All work under this Item shall be executed in such a manner so as not to disturb or damage the existing utilities.

The work shall consist of removing all obstructions interfering with the pile extraction in the vicinity of the proposed drilled shafts as shown on the Plans. Excavation by hand may be required to expose the top of timber piles which interfere with the proposed drilled shafts construction. The Contractor shall extract the piles in a way so that the piles will not break. All excavation required for satisfactory completion of this work shall be considered incidental to this item.

The Contractor shall obtain all approvals and permits required for all operations as may be required for the removal of the existing timber piles.

All materials removed under this Item shall become the property of the Contractor and shall be disposed of by the Contractor off the site and in a lawful manner meeting all IDOT Policies and Procedures.

Construction Requirements. The Contractor shall submit drawings, complete with a list of equipment and methods the Contractor proposes to use for the removal and disposal of all existing timber pile to the Engineer for review. Further, the Contractor shall submit copies of all approvals and permits for the work under this Item to the Engineer. All work under this Item shall be performed so as not to disturb adjacent facilities or construction. The removal shall include all timber piles and related materials encountered at each existing timber pile. If an existing timber pile breaks during removal operations, the Contractor is required to remove the remaining remnants of the existing timber pile prior to installation of any Drilled Shaft.

Method of Measurement. Removal of existing pile shall be measured for payment by the number (each) of the complete pile. No other or separate measurement will be made for this Item.

Basis of Payment. The work under this Item will be paid for at the Contract unit price each for PILE EXTRACTION, as indicated on the Plans and as specified herein.

REMOVAL OF ASBESTOS CEMENT CONDUIT

Description: This work consists of the removal and disposal of friable asbestos cement electrical conduits owned by the City of Chicago. The conduits shall be demolished including conduit supports and hangers. All work shall be done in accordance with the requirements of the U.S. Environmental Protection Agency (USEPA), the Illinois Environmental Protection Agency (IEPA), the Occupational Safety and Health Administration (OSHA), and as outlined herein.

Under the Peoria Street Bridge structure, the City of Chicago has a 3 duct package that provides connections for CDOT Department of Electrical Operations across I-290. There may be active facilities in the ducts that will be temporarily rerouted during construction. Portions of the existing ducts are concrete encased.

The City of Chicago has identified that records are unclear if asbestos concrete is present in the existing conduits. Prior to any removal of any conduit material, the existing conduits must be tested for the presence of asbestos content by qualified personnel and/or qualified testing firm. Tests should be comprehensive, and include detailed visual inspection, sampling as determined by qualified testing firm or personnel and laboratory testing of samples in order to determine if conduits include asbestos cement. Each of the existing conduits should be independently reviewed due to unknown installation or maintenance improvement records. No separate payment for testing of the existing conduits will be made. The testing of existing conduits shall be included as part of REMOVAL OF EXISTING STRUCTURES. All testing records and results shall be provided to the engineer prior to any removal of existing City of Chicago conduits.

If testing identifies that asbestos cement is not present in the existing conduits, the conduits shall be demolished as part of REMOVAL OF EXISTING STRUCTURES. If testing identifies that asbestos cement is present in the existing conduits, the removal of the conduits shall follow the procedures identified within this specification.

The City of Chicago conduits attached to the Peoria Street Bridge are concrete encased across the bridge. The concrete encased ducts shall be carefully removed in sections in order to properly segregate the ducts from the concrete encasement in a safe and secure area.

The work involved in the removal and disposal of friable or non-friable asbestos done prior to demolition of the Peoria Street Bridge structure shall be performed by a qualified Contractor or Sub-Contractor.

The Contractor shall provide a shipping manifest to the Engineer for the disposal of all asbestos containing material wastes.

The Contractor shall coordinate with the City of Chicago for the replacement of their ducts under this contract. The Contractor shall coordinate with ComEd and AT&T for the removal of their ducts by others. Existing ComEd and AT&T ducts parallel to the City of Chicago ducts may contain asbestos.

Permits: The Contractor shall apply for permit(s) in compliance with applicable regulations of the Illinois Environmental Protection Agency. Any and all other permits required by other federal, state, or local agencies for carrying on the work will be the responsibility of the Contractor. Copies of these permits must be sent to the district office and the Engineer.

Notifications: The “Demolition/Renovation Notice” form, which can be obtained from the IEPA office, shall be completed and submitted to the agencies listed below at least 10 days prior to commencement of any asbestos removal or demolition activity.

- A. Asbestos Demolition/Renovation Coordinator
Illinois Environmental Protection Agency
Division of Air Pollution Control
P. O. Box 19276
Springfield, Illinois 62794-9276
(217)785-1743

- B. U. S. Environmental Protection Agency
Air Compliance Branch
77 W. Jackson Blvd.
Chicago, Illinois 60604
Attention: Asbestos Coordinator

Notices must be updated if there is a change in the starting date or the amount of asbestos changes by more than 20 percent

Submittals

- A. All submittals and notices shall be made to the Engineer except where otherwise specified herein.

- B. Submittals that shall be made prior to start of work:
 - 1. Submittals required under Asbestos Abatement Experience.
 - 2. Submit documentation indicating that all employees have had medical examinations and instruction on the hazards of asbestos exposure, on use and fitting of respirators, on protective dress, on use of showers, on entry and exit from work areas, and on all aspects of work procedures and protective measures as specified in Worker Protection Procedures.
 - 3. Submit manufacturer's certification stating that vacuums, ventilation equipment, and other equipment required to contain airborne fibers conform to ANSI 29.2.
 - 4. Submit to the Engineer the brand name, manufacturer, and specification of all sealants or surfactants to be used. Testing under existing conditions will be required at the direction of the Engineer.
 - 5. Submit proof that all required permits, site locations, and arrangements for transport and disposal of asbestos-containing or asbestos-contaminated materials, supplies, and the like have been obtained (i.e., a letter of authorization to utilize designated landfill).

- Information about vehicles and equipment utilized for transport of material designated for disposal shall be submitted. This should include methods for restricting loose fibers from being released during travel.
6. Submit a list of penalties, including liquidated damages, incurred through non-compliance with asbestos abatement project specifications.
 7. Submit a project specific Health and Safety plan for the removal operations. The Health and Safety Plan must be approved and signed by sub-contractor and contractor personnel, and shall be provided to the Engineer prior to commencing site work activities. The Contractor shall be and remain liable for compliance by its employees, agents and subcontractors with the Contractor's Health and Safety Plan and procedures for the site and shall hold Engineer and Department harmless from all claims, damages, suits, losses and expenses in any way arising from non-compliance with the Health and Safety Plan.
 - i. In particular, the Health and Safety Plan shall address personal protection from asbestos fiber releases during asbestos abatement.
 8. Submit a detailed plan of the procedures proposed for use in complying with the requirements of this specification. Include in the plan the location and layout of decontamination units, the sequencing of work, the respiratory protection plan to be used during this work, a site safety plan, a disposal plan including the location of an approved disposal site, and a detailed description of the methods to be used to control pollution. The plan must be submitted to the Engineer prior to the start of work.
 9. Submit proof of written notification and compliance with Paragraph "Notifications."
- C. Submittals that shall be made upon completion of abatement work:
1. Submit copies of all waste chain-of-custodies, trip tickets, and disposal receipts for all asbestos waste materials removed from the work area;
 2. Submit daily copies of work site entry logbooks with information on worker and visitor access;
 3. Submit logs documenting filter changes on respirators. HEPA vacuums, negative pressure ventilation units, and other engineering controls; and
 4. Submit results of any bulk material analysis and air sampling data collected during the course of the abatement including results of any on-site testing by any federal, state, or local agency.

Certificate of Insurance:

- A. The Contractor shall document general liability insurance for personal injury, occupational disease and sickness or death, and property damage.
- B. The Contractor shall document current Workmen's Compensation Insurance coverage.
- C. The Contractor shall supply insurance certificates as specified by the Department.

Asbestos Abatement Experience:

A. Company Experience:

1. Prior to start of work, the Contractor shall supply:
 - a. Evidence that he/she has been qualified with the State of Illinois and he/she has been included on the Illinois Department of Public Health's list of approved Contractors.

B. Personnel Experience:

1. For Superintendent, the Contractor shall supply:
 - a. Evidence of knowledge of applicable regulations in safety and environmental protection is required as well as training in asbestos abatement as evidenced by the successful completion of a training course in supervision of asbestos abatement as specified in 40 CFR 763, Subpart E, Appendix C, EPA Model Contractor Accreditation Plan. A copy of the certificate of successful completion must be provided to the Engineer prior to the start of work.
 - b. Documentation of experience with abatement work in a supervisory position as evidenced through supervising at least two asbestos abatement projects; provide names, contact, phone number, and locations of two projects in which the individual(s) has worked in a supervisory capacity.
 - c. The superintendent shall be thoroughly familiar with and experienced at asbestos abatement, characterization, bulking, transportation, and disposal activities and other related work, and shall be familiar with and shall enforce the use of all applicable safety procedures and equipment. The Supervisor shall be knowledgeable of, and enforce, all applicable, USEPA, IEPA, and OSHA requirements and guidelines.

2. For Workers involved in the Removal of Friable and Nonfriable Asbestos the Contractor shall provide:
 - a. Training as evidenced by the participation and successful completion of an accredited training course for asbestos abatement workers as specified in 40 CFR 763, Subpart E, Appendix C, EPA Model Contractor Accreditation Plan. A copy of the certificate of successful completion must be provided to all employees who will be working on this project.
 - b. Workers shall be familiar with and experienced at asbestos abatement, characterization, bulking, transportation, and disposal activities and other related work; and Asbestos Workers shall be familiar with the use of applicable safety procedures and equipment.

Abatement Air Monitoring:

The Contractor shall comply with the following:

A. Personal Monitoring:

1. All personal monitoring shall be conducted per specifications listed in OSHA regulation, Title 29, Code of Federal Regulation 1926.58. All area sampling shall be conducted in accordance with 40 CFR Part 763.90. All air monitoring equipment shall be calibrated and maintained in proper operating condition. Excursion limits will be monitored daily. Personal monitoring is the responsibility of the contractor. Additional personal samples may be required by the Engineer at any time during the project.

B. Contained Work Areas for Removal of Friable Asbestos

1. Area samples shall be collected for the department within the work area daily. A minimum of one sample shall be taken outside of the abatement area removal operations. The Engineer will also have the option to require additional personal samples and/or clearance samples during this type of work.

C. Air Monitoring Professional

1. All air sampling will be conducted by a qualified Air Sampling Professional supplied by the Contractor. The Air Sampling Professional must submit documentation of successful completion of the National Institute for Occupational Safety and Health (NIOSH) course #582 – “Sampling and Evaluating Airborne Asbestos Dust”.
2. Air Sampling will be conducted in accordance with NIOSH Method 7400. The results of these tests will be provided to the Engineer within 24 hours of the collection of air samples.

Method of Measurement: This work will be measured for payment per foot for REMOVAL OF ASBESTOS CEMENT CONDUIT, as shown for each individual conduit, which price shall include furnishing all labor, materials, equipment and services required to remove and dispose of the friable asbestos cement conduits, hangers, and conduit supports. No separate payment will be made for any testing of existing conduits for the presence of asbestos cement prior to the removal of any conduit material. Removal of concrete encasement is to be included in REMOVAL OF EXISTING STRUCTURES.

Basis of Payment: This work will be paid for at the contract unit price per foot for REMOVAL OF ASBESTOS CEMENT CONDUIT for all conduits identified to contain asbestos and removed in accordance with this specification and all current laws and regulations.

MAINTENANCE OF STREET LIGHTING SYSTEM (CITY OF CHICAGO)

Description. This item consists of furnishing all labor, equipment, and incidental materials for maintaining existing street lighting and underpass lighting systems until the proposed new equipment is installed, energized, tested, and accepted for operation by the Commissioner.

The work must include any necessary temporary devices to maintain existing illumination. The location and protection devices necessary to comply with these requirements will be subject to the approval of the Commissioner.

Any temporary wire or cable which may be required to be installed overhead between existing poles, existing underpass luminaires, or temporary devices must be furnished, installed, terminated, and maintained in service until the proposed lighting equipment is installed, tested, and accepted for operation by the Commissioner.

Materials. Materials must be according to the applicable Department of Electrical Operations (DEO) Specifications and Articles of Standard Specifications Section 1000 - Materials as noted elsewhere in these Specifications.

General Requirements. General requirements must be in accordance with Section 801 of the Standard Specifications, and in accordance with Department of Electrical Operations Standards and the City of Chicago Electrical Code, except as herein modified.

The Contractor shall MAINTENANCE OF STREET LIGHTING SYSTEM (CITY OF CHICAGO) (temporary and permanent) and proposed lighting systems, as well as receptacles and other ancillary devices connected to the applicable street or underpass lighting controllers. Effective the day the Contractor starts work, the Contractor must maintain the existing lighting equipment located within the project limits as it then exists.

Inspection of Electrical Systems: Add the following to Article 801.11 of the Standard Specifications:

"Maintenance Preconstruction Inspection:

General. Before performing any excavation, removal, or installation work (electrical or otherwise) at the site, the Contractor must request a maintenance preconstruction site inspection, to be held in the presence of the Commissioner and a representative of the party or parties responsible for maintenance of any lighting and/or traffic control systems which may be affected by the work. The request for the maintenance preconstruction inspection must be made no less than seven (7) calendar days prior to the desired inspection date. The maintenance preconstruction inspection shall:

Establish the procedures for formal transfer of maintenance responsibility required for the construction period.

Establish the approximate location and operating condition of lighting and/or traffic control systems which may be affected by the work.

Marking of Existing Cable Systems. The party responsible for maintenance of any existing lighting and/or traffic control systems at the project site will, at the Contractor's request, mark and/or stake, once per location, all underground cable routes owned or maintained by the City. A project may involve multiple "locations" where separated electrical systems are involved (i.e. different controllers). The markings shall be taken to have a horizontal tolerance of at least one (1) foot to either side. The request for the cable locations and marking shall be made at the same time the request for the maintenance preconstruction inspection is made. The Contractor must exercise extreme caution where existing buried cable runs are involved. The markings of existing systems are made strictly for assistance to the Contractor and this does not relieve the Contractor of responsibility for the repair or replacement of any cable run damaged in the course of his work, as specified elsewhere herein. NOTE THAT THE CONTRACTOR WILL BE ENTITLED TO ONLY ONE REQUEST FOR LOCATION MARKING OF EXISTING SYSTEMS AND THAT MULTIPLE REQUESTS MAY ONLY BE HONORED AT THE CONTRACTOR'S EXPENSE. NO LOCATES WILL BE MADE AFTER MAINTENANCE IS TRANSFERRED, UNLESS IT IS AT THE CONTRACTOR'S EXPENSE.

Condition of Existing Systems. The Contractor must conduct an inventory of all existing electrical system equipment within the project limits, which may be affected by the work, making note of any parts which are found broken or missing, defective or malfunctioning. Megger and load readings must be taken for all existing circuits which will remain in place or be modified. If a circuit is to be taken out in its entirety, then readings do not have to be taken. The inventory and test data will be reviewed with and approved by the Commissioner and a record of the inventory must be submitted to the Commissioner for the record. Without such a record, all systems transferred to the Contractor for maintenance during construction must be returned at the end of construction in complete, fully operating condition."

Damage to Electrical Systems. Delete the last paragraph of Article 801.06 of the Standard Specifications.

Lighting Operation and Maintenance Responsibility. The scope of work includes the assumption of responsibility for the continuing operation of existing, temporary or other lighting systems and all appurtenances affected by the work as may be specified elsewhere herein. Existing lighting systems, when depicted on the plans, are intended only to indicate the general equipment installation of the systems involved and must not be construed as an exact representation of the field conditions. It remains the Contractor's responsibility to visit the site to confirm and ascertain the exact extent of the electrical equipment and systems to be maintained. Where there is existing lighting within the project limits, prior to the start of activities at the site, the Contractor must schedule a formal transfer of maintenance via the Commissioner, however failure to do so does not relieve the Contractor of the maintenance responsibility specified herein and such failure obligates the Contractor to correct deficiencies in the existing system at his own expense.

Effective the date the Contractor's activities (electrical or otherwise) at the job site begin, the Contractor will be responsible for the proper operation and maintenance of all existing lighting systems which may be affected by the work for which maintenance has been transferred to the Contractor and all temporary and newly constructed lighting systems under this Contract, until final acceptance or as otherwise determined by the Commissioner.

Except as specified herein, the Contractor's responsibility will include all applicable responsibilities of the City of Chicago, Department of Streets and Sanitation. These responsibilities will include lighting units (including underpass and navigational lighting), cable runs and lighting controls.

Electrical System Damage Response. The Contractor must respond to damage calls for all system components being maintained and/or installed by the Contractor, existing and proposed, including, but not limited to pole knockdowns, circuit outages, more than 3 luminaires on a circuit, 3 successive luminaires, and controller outages within one hour after notification and provide immediate corrective action. The Contractor must also repair other outages within 5 days. The Contractor must maintain in stock a sufficient amount of material and equipment to provide temporary and permanent repairs. Any damage to the lighting system from any cause whatsoever must be repaired or replaced in kind with equipment in the same condition before the incident or with new equipment provided by the Contractor at no additional cost to the Contract, all as approved by the Commissioner. If the Contractor fails to respond so as to produce immediate corrective action within the specified time frames, or fails to complete repairs in a timely manner the Commissioner may direct other forces, such as the City's Maintenance Contractor, to perform the work. Charges incurred will be direct billed to the Contractor. The City will retain all rights to pursue claims against third parties in all situations regardless of who is maintaining the system. The Contractor must also provide the City with all accident and damage reports from any incidents.

Weekly Night-time Patrols. Responsibilities must also include weekly night-time patrol of the lighting system, with patrol reports filed immediately with the Commissioner and with deficiencies corrected within 24 hours of the patrol. Patrol reports must be presented on standard forms as designated by the Commissioner. Uncorrected deficiencies may be designated by the Commissioner as necessitating emergency repairs as described elsewhere herein. Failure to submit patrol reports on a weekly basis will result in a Penalty for Non-Compliance as specified herein.

Contractor's Responsibility. Existing lighting systems which may be affected by the work will include, as a minimum, all existing lighting units within the project limits and these units may be temporarily isolated by means of in-line waterproof fuse holders as approved by the Commissioner. When a controller is to be replaced or modified under the Contract work, or where otherwise indicated, the controller and all systems connected to it must be included in the Contractor's responsibility for proper operation of lighting systems. The Contract Drawings may indicate the general extent of any existing lighting, but whether indicated or not, it remains the Contractor's responsibility to ascertain the extent of effort required for compliance with these specifications and failure to do so will not be justification for extra payment or reduced responsibilities.

Energy and Demand Charges. The payment of basic energy and demand charges by the electric utility for existing lighting which remains in service will continue as a responsibility of the Owner, unless otherwise indicated. Unless otherwise indicated or required by the Commissioner duplicate lighting systems (such as temporary lighting and proposed new lighting) shall not be operated simultaneously at the Owner's expense and lighting systems will not be kept in operation during long daytime periods at the Owner's expense. Upon written authorization from the Commissioner to place a proposed new lighting system in service, whether the system has passed final acceptance or not, (such as to allow temporary lighting to be removed), the Owner will accept responsibility for energy and demand charges for such lighting, effective the date of authorization. All other energy and demand payments to the utility will be the responsibility of the Contractor until final acceptance.

Coordination Requirements for Existing and Temporary Lighting. The Contractor must coordinate maintenance of existing, temporary, and proposed lighting with the sequence of construction and maintenance of traffic for this Project.

Installation. Location of cables and fixtures for temporary lighting as required must be adjusted and supported to accommodate field conditions encountered, including any potential interferences with other construction or equipment to be installed.

The Contractor will determine the exact route and location of each temporary lighting fixture and associated wiring, prior to installation.

Temporary lighting must be installed to permit removal (without damage to other parts) of parts requiring periodic replacement or maintenance.

Temporary wiring/lighting must be removed immediately upon acceptance of permanent lighting.

Penalty for Non-Compliance. The Contractor will be subject to a penalty of \$500.00 per incident, per day, to be deducted from next pay estimate due Contractor, for each occurrence when the Commissioner determines that Contractor or his Subcontractor is not in full compliance with this Section of the Specifications.

Penalty for Failure to Respond. The Contractor is required to respond within ½ hour to any request from the Commissioner for repair or replacement of any broken, defective and/or missing parts as specified under this section. "Response" is interpreted to mean on the job, preparing to make repairs. Failure by Contractor to so respond will be grounds for a penalty of \$500.00 for each and every occurrence, to be deducted from next pay estimate due Contractor.

Reimbursement. If the Contractor utilizes any lighting equipment owned by the City or uses existing ComEd service, the Contractor must compensate the City for such usage.

Method of Measurement. MAINTENANCE OF STREET LIGHTING SYSTEM (CITY OF CHICAGO) will be measured for payment per lump sum.

The contractor shall demonstrate to the satisfaction of the Engineer that the lighting system is fully operational prior to submitting a pay request. Failure to do so will be grounds for denying the pay request.

Basis of Payment. This work will be paid for at the contract lump sum price for MAINTENANCE OF STREET LIGHTING SYSTEM (CITY OF CHICAGO), which will be payment in full for: furnishing and installing all temporary lighting units; maintaining existing, temporary, and proposed lighting systems; and aerial cable and ancillary equipment required to maintain the existing lighting system as described herein, as directed by the Engineer and as required for a complete functional lighting system.

TELEVISION INSPECTION OF SEWER

Description. This work will consist of televising the storm sewer and combined sewer systems before and after construction as specified in the contract drawings.

Requirements. The Contractor must furnish a videotape of a televised inspection of the interior of all existing storm and combined sewers which may be impacted during construction under this contract. Record the videotape under the supervision of the Engineer. Perform two sessions of videotaping of the sewer: 1) before construction and 2) prior to the placement of final wearing surface.

The name, phone number, and contact person of the firm which will be performing the videotaping of the sewer must be provided by the Contractor at the pre-construction meeting.

Clean all sewers prior to videotaping before construction. The final acceptance of the sewer shall be based on the sewer videotape. All deficiencies exposed on the second videotape which were not exposed on the initial videotape must be corrected by the Contractor within 30 calendar days of notification. All costs incurred by the Contractor to make the required repairs are to be borne solely by the Contractor. The Contractor is required to re-videotape the sewer to verify that these deficiencies have been corrected to the satisfaction of the Chicago Department of Sewers. All costs to re-videotape the sewer, regardless of the number of times required, will be borne solely by the Contractor.

Every effort is to be made by the Contractor to correct all deficiencies prior to the placement of the final wearing surface. If, in the opinion of the Engineer, the Contractor has delayed in submitting the videotape, the placement of the final wearing surface may be suspended. No time extension will be granted due to this suspension and the Engineer will be sole judge as to any delays.

Include location maps, legends and descriptions on all videotape submittals. 2 copies of each submittal are required.

Method of Measurement. This work will be measured for payment in sewer televising per foot for the videotaping of the sewer before construction and prior to placement of the final wearing surface.

Basis of Payment. This work will be paid for at the contract unit price per foot for the TELEVISION INSPECTION OF SEWER or TELEVISION INSPECTION OF SEWER, SPECIAL.

The cleaning of sewers prior to videotaping before construction shall be paid for as STORM SEWERS TO BE CLEANED, of the diameter specified, or at the contract unit price per foot for COMBINED SEWERS TO BE CLEANED or COMBINED SEWERS TO BE CLEANED, SPECIAL.

REMOVE EXISTING CABLE

Description. This work will consist of disconnecting, removing and disposing of existing cable from a conduit. The cable must be pulled out of an existing conduit, removed completely and disposed as specified herein, as shown on the plans and as directed by the Engineer.

No removal work shall be permitted without approval from the Engineer. All cables removed as part of this item shall become property of the Contractor and shall be removed from the site, unless otherwise directed.

Method of Measurement. The removed cable will be measured for payment in feet in place, regardless of cable type and size. Measurement will be made in a straight line between changes of direction and to the centers of poles, handholes, junction boxes and manholes. Slack cable and vertical cable will not be measured for payment. Multi-conductor cables within a single outer jacket shall be measured the same as single conductor cables.

Basis of Payment. This work shall be paid for at the contract unit price for REMOVE EXISTING CABLE as specified. The price will be payment in full for completely removing and disposing of the existing cable from a conduit. If two or more cables in a conduit are to be removed, each cable will be measured for payment separately.

CABLE IN CONDUIT, TRIPLEX 2-1/C NO. 6 AND 1-1/C NO. 8 GROUND

Description. This work will consist of furnishing and installing electric cable that is triplexed. The cable must be rated at 600 volts and must consist of two number 6 conductors and one number 8 conductor. The cable will be installed in conduit underground.

Material. The cable must meet all requirements of Material Specification 1534 of the Bureau of Electricity, City of Chicago.

Construction Method. All cables must be installed with care to prevent damage to the cable. Any defects found in the cable must be reported to the Engineer. Damaged cable must be replaced.

The cable must be pulled into the conduit with a minimum of dragging on the ground or pavement. This will be accomplished by means of reels mounted on jacks or other suitable devices located for unreeling cable directly into duct. Lubricants must be used to facilitate installation if deemed necessary by the Contractor.

Bends in the cable will conform to the recommended minimum radii as outlined in the National Electric Code.

Cable passing through manholes must be trained and racked around the sides of the manhole into a permanent position. If racks are non-existent or in poor condition, the Contractor must install racks. The material must be approved by the Engineer. Any material and labor involved in training and racking the cable will be considered incidental to the cost of this pay item.

Where cable runs continue from manhole to manhole without tapping within a light pole, they will be continuous without splices unless authorized by the Engineer.

The cable installation must be color coded so that each lead of all circuits may be easily identified and lighting units connected to the proper leg as indicated on the plans. The equipment grounding conductor (no. 8) must be color coded green.

All wire or cable in the distribution panels and control cabinets must be properly trained and have sufficient slack provided for any rearrangement of equipment or future additions.

There must be at least three feet of slack in a street light pole base or street light controller base. A handhole must have at least five feet of slack and a manhole at least ten feet of slack.

Method of Measurement. The length of triplex cable furnished and installed will be measured as the length of conduit plus three feet for cable entering and leaving a light pole or street light control cabinet, plus any slack in manholes or handholes.

Basis of Payment. This work shall be paid for at the contract unit price per lineal foot for CABLE IN CONDUIT, TRIPLEX, 2 1/C NO.6 AND 1-1/C NO.8. GROUND The price will be payment in full for furnishing, installing, and testing the cable, and will include all material, labor, terminations, and incidentals necessary to complete the work as per the contract plans.

CONCRETE BARRIER BASE (SPECIAL)

Description. This work shall consist of constructing a concrete barrier base with reinforcement bars below a concrete barrier wall or concrete barrier transition as detailed in the plans.

Construction Requirements. This work shall be done in accordance with the applicable portions of Section 637 of the Standard Specifications. The concrete barrier base shall be constructed as detailed in the plans. The concrete barrier wall or concrete barrier transition shall be constructed separately and not poured monolithically with the concrete barrier base.

Method of Measurement. CONCRETE BARRIER BASE (SPECIAL) shall be measured for payment in feet along the centerline of the base. The concrete barrier wall and concrete barrier transition will be paid for separately according to CONCRETE BARRIER WALL (SPECIAL) and CONCRETE BARRIER TRANSITION (SPECIAL).

Basis of Payment. This work will be paid for at the contract unit price per foot for CONCRETE BARRIER BASE (SPECIAL), which price shall include all equipment, labor, and materials necessary to construct the concrete barrier base including all reinforcement bars in the concrete barrier base and those extending into the concrete barrier wall or concrete barrier transition.

DECORATIVE RAILING (PARAPET MOUNTED)

The railing shall conform to Section 503 and 509 of the Standard Specifications except as herein modified.

Description. This Work consists of furnishing and installing Chicago Barrier aluminum railing system of the type specified at locations shown on the Plans or directed by the Engineer, and in accordance with the details shown in the Plans.

Materials. Aluminum alloys 6063-T6 and 6061-T6 can be used interchangeably at the option of the manufacturer, with the requirements that the minimum physical properties must be 2500 PSI yield, 30,000 PSI Ultimate yield, and 10% elongations.

Color and Finish. Clear anodized with minimum 1.0 mil thickness. Color samples are to be submitted to the Engineer for approval.

General. The rail sections must be factory pre-bent into curves to form radii rather than employing angular splices at the expansion joints. Any bending must be done prior to finishing to avoid distortion of the rail and/or damage to the finishing properties of the alloy.

Submittals.

1. Manufactures certification that aluminum rail and connections meet IDOT and CDOT specifications.
2. Shop drawings including wall and railing system.
3. Color and finish sample of railing.
4. Mockup of railings. One 10' panel including stanchions.
5. Calculations signed and sealed by an Illinois Registered Professional Structural Engineer.

Coordination: Coordinate with Chicago Wall concrete barrier manufacturer, fence manufacturer, electrical and traffic surveillance requirements to install conduit and junction boxes.

Complete shop drawings and calculations by an Illinois Registered Professional Structural Engineer, and field installation drawings must be submitted to the Engineer for approval prior to ordering materials, commencement of any shop fabrication, and/or finishing.

Aluminum Railing. The aluminum rail system must be in accordance with the Plans and with AASHTO-AGC-ARTBE Joint Committee Task Force 13 Report "A Guide to Standardized Highway Barrier Hardware." This system must meet and match the shape and composition of the Aluminum Railing as furnished and installed for the North Lake Shore Drive Project. Alternate systems that meet all requirements and specifications will be considered by the Engineer if submitted for approval at the time of the Pre-Bid Conference.

There will be a single source responsibility for the aluminum rail system, which will include but not be limited to the aluminum railing, the aluminum supports (stanchion system), anodizing, splices, finish, thief protection system, structural calculations, and the design of all components above the top horizontal plane of the concrete wall system, bolts, fasteners, welding, shop fabrication, field erection, anchoring system, and freight etc. Bolts, studs, and embedment required must also be by the Contractor.

Design Requirements. The design requirements must be as set forth in the AASHTO Task Force 13 Report ("A Guide to Standardized Highway Barrier Hardware")

The cross section must conform to an ellipse 4" x 7 7/8".

Exposed fasteners must be stainless steel. All bolts must be A307.

No field welding will be permitted.

Structural Requirements: The aluminum railing system must conform to the requirements of AASHTO "Standard Specifications for Highway Bridges" Section 2.7.

All thickness and material specifications requirements, unless otherwise approved by the Engineer, must be based on certifications based on structural calculations provided by the Contractor.

Acceptable Rail Manufactures:

1. Valentine & Company, Middletown, OH.
2. Approved Equal.

Method of Measurement. This Work will be measured for payment, complete in place, per foot.

Basis of Payment. This Work will be paid for at the Contract Unit Price per foot for DECORATIVE RAILING (PARAPET MOUNTED), which price includes furnishing and placing all material required, including all labor, equipment and incidentals necessary to complete the Work as herein specified.

CLEANING EXISTING SEWERS

Description. All existing storm sewers and combined sewers shall be considered as sewers insofar as the interpretation of this Special Provision is concerned. When specified for payment, the location of sewer to be cleaned will be shown on the plans.

All existing drainage structures which are to be adjusted or reconstructed shall be cleaned according to Article 602.15 of the Standard Specifications. This work will be paid for in accordance with Article 602.16 of the Standard Specifications.

All existing storm sewers and combined sewers which are specified to be cleaned on the plans will be cleaned according to Article 602.15.

Method of Measurement. This work will be measured for payment in feet for the length of sewer that is cleaned.

Basis of Payment. This work will be paid for at the contract unit price per foot for STORM SEWERS TO BE CLEANED, of the diameter specified, or at the contract unit price per foot for COMBINED SEWERS TO BE CLEANED or COMBINED SEWERS TO BE CLEANED, SPECIAL or BOX CULVERT TO BE CLEANED.

CROSSHOLE SONIC LOGGING

Description. This item shall consist of furnishing and installing test equipment access tubes in drilled shafts on the project, conducting Crosshole Sonic Logging (CSL) testing on drilled shafts to verify concrete quality, providing a report containing the test results and analysis, and subsequent grouting of the access tubes. The Engineer will determine which drilled shafts will have CSL testing and may expand the number of drilled shafts tested, beyond the number indicated in the summary of quantities.

The CSL test shall follow ASTM 6760 and measure the strength and time for an ultrasonic pulse to travel from a signal source in one access tube to a receiver in another access tube. In uniform, good quality concrete, the travel time between equidistant tubes should yield relatively consistent arrival times and corresponds to a reasonable pulse velocity, signal amplitude and energy from the bottom to the top of the shaft. Longer travel times, decrease in pulse velocity, and lower amplitude/energy signals indicate the presence of irregularities such as poor quality concrete, voids, honeycombing, cracking and soil intrusions.

Prequalification Requirements The CSL testing consultant shall have a minimum of two years of acceptable experience in CSL drilled shaft testing. No later than thirty (30) days prior to beginning drilled shaft construction, the Contractor shall submit to the Engineer for approval the following information:

- (a) Name, address, and phone number of the CSL testing consultant selected to perform the testing.
- (b) Names and experience of field staff conducting testing and engineer responsible for analyzing the results.
- (c) List of at least two (2) projects on which this consultant has successfully completed CSL testing. The list shall include a brief description of the project, the client or owner name and phone number, and number of shafts tested.

Submittals. No later than thirty (30) days prior to beginning drilled shaft construction, the Contractor shall submit to the Engineer for approval the following information:

- (a) Description of testing equipment and testing sequence on a typical shaft. Any modification or deviation to the testing procedures required by this special provision shall be so indicated.
- (b) The CSL tube size, materials compliance, end and top cap details, couplings, any coupling joints details, and the proposed method of attaching the tubes to the cage.
- (c) An example CSL report showing both sound and defective concrete.

Materials. The materials required for this item shall consist of the following:

- (a) The test equipment access tubes shall be either 1.5 inch (38 mm) or 2 inch (50 mm) inside diameter Schedule 80 or 40 steel pipe conforming to ASTM A53, Grade A or B, Type E, F, or S.
- (b) The grout used to fill the access tubes shall be a non-shrink 5000 psi (34.4 MPa) compressive strength grout according to Section 1024.

Equipment. The minimum requirements of the CSL testing equipment are as follows unless otherwise approved as part of the Contractor's submittal:

- (a) A microprocessor based CSL system for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses and printing of report quality CSL logs
- (b) Ultrasonic source and receiver probes must be small enough to travel through 1.5 inch (38 mm) or 2 inch (50 mm) I.D. steel pipe access tubes and extend the full depth of the tube.
- (c) The probes shall be capable of producing records at a minimum frequency of 40,000Hz with good signal amplitude and energy in typical concrete.
- (d) An ultrasonic voltage pulser to excite the source with a synchronized triggering system to start the recording system.
- (e) A depth measurement device to electronically measure and record the source and receiver depths associated with each CSL signal.
- (f) Appropriate filter/amplification and cable systems for CSL testing.
- (g) An acquisition system that stores each log in digital format, with drilled shaft identification, date, time and test details, including the source and receiver gain. Arrival time data must be displayed graphically during data acquisition.
- (h) 3D tomographic imaging software, or source for completing the work

The equipment must be capable of providing the test results on thermal or graphical printouts with the vertical scale representing the vertical position along the shaft, and the horizontal scale representing the propagation time.

CONSTRUCTION REQUIREMENTS

Access tubes:

The Contractor shall place access tubes in all drilled shafts on the project unless otherwise indicated on the Plans or approved by the Engineer. The CSL Consultant must contact the drilled shaft Contractor and provide the technical instruction and guidance on obtaining and installing the access tubes so they will provide adequate bond to the concrete and yield the necessary data. The tubes must have a round, regular internal diameter, free of defects or obstructions to permit the free passage of the source and receiver probes. Four access tubes shall be installed in all drilled shafts with a diameter of 4.5 feet or less, five access tubes are required in shafts between 5 feet and 6 feet in diameter, six access tubes shall be used in 6.5 feet and 7.0 feet diameter shafts while eight tubes are required on larger shafts. Install the tubes in each drilled shaft in a regular, symmetric pattern such that each tube is equally spaced from the others around the perimeter of the cage. Tube placement must be such that large vertical reinforcing bars do not block the direct line between adjacent tubes. Securely attach the tubes to the interior of the reinforcement cage at vertical intervals not to exceed 3 feet (1 m) or otherwise secured such that the tubes remain in position during placement of the rebar cage and the concrete. The tubes must be vertical and parallel. Extend the tubes from 6 inches (150 mm) above the shaft tip to at least 3 feet (1 m) above the top of the shaft. If the shaft top elevation is below ground elevation, extend tubes at least 2 feet (610 mm) above ground surface. If the drilled shaft tip elevation is extended more than 1 foot (305 mm) below the tip elevation shown in the Plans, extend the tubes using proper threaded mechanical couplings to within 6 inches (150 mm) of the final tip elevation. Any joints used to construct the full tube length must be threaded mechanical couplings that produce a smooth interior surface, occur at the same elevation in each tube within the shaft and be watertight. Threaded water tight end caps shall be used at the bottom of each tube and a removable threaded end cap shall be provided on the top of the tubes. Do not use duct tape, other wrapping materials, or butt welding to seal joints. Under no circumstance will the tubes be allowed to rest on the bottom of the shaft excavation. Take care to not damage the tubes during the placement of reinforcing cage and the concrete. Before placement of the reinforcement cage into the shaft excavation, record the tube lengths and tube positions along the length of the cage. After placement of concrete, measure the stickup of the tubes above the top of the drilled shaft and verify tube spacing. After placement of the reinforcement cage and within 2 hours after concrete placement, fill the CSL tubes with clean, potable water, and cap them to keep out debris. The Engineer will reject tubes not filled and capped within 2 hours.

CSL Testing Procedure:

The testing shall be conducted between 3 and 40 days after the drilled shaft has been placed and after concrete has attained 2/3 of the specified strength. The Contractor shall provide suitable access to the top of the shafts and any electricity, grout, water or other equipment support necessary to satisfy the CSL testing requirements. When removing the access tube caps, exercise care not to apply excess torque, force or stress, which could break the bond between the tubes and the concrete. The Contractor shall provide the CSL consultant with the as-constructed tube positions in each shaft including each tube length, top of tube elevation, top of shaft elevation, bottom of shaft elevation, and construction dates prior to beginning CSL testing.

Conduct CSL tests between each unique pairing of access tubes (i.e. 4 tubes have 6 different combinations, 5 have 10 combinations, 6 have 15, etc.). Perform the CSL testing with the source and receiver probes in the same horizontal plane unless test results indicate defects or poor concrete zones, in which case the defect zones must be further evaluated with angle tests (source and receiver vertically offset in the tubes). Report any defects indicated by decreased signal velocity and lower amplitude/energy signals to the Engineer at the time of testing, and conduct angle tests in the zones of the defects as defined by the Concrete Condition Rating Criteria (CCRC). Make CSL measurements at depth intervals of 3 inches (75 mm) or less from the bottom of the tubes to the top of each shaft. Pull the probes simultaneously, starting from the bottom of the tubes, using a depth-measuring device to electronically measure and record the depths associated with each CSL signal. The speed of ascent shall be less than 12 inches per second (300 mm/second). Remove any slack from the cables before pulling to provide for accurate depth measurements of the CSL records. In the event defects are detected, conduct additional logs, as needed, to fully identify the extent of the anomaly.

If steel tube debonding occurs, a 2 inch (50 mm) diameter hole shall be drilled to below the depth of debonding for each debonded tube in order to perform the CSL testing.

CSL Report:

The test results shall be submitted to the Engineer in the form of a report within 7 working days of completion of CSL testing. The CSL report should include but is not limited to the following:

- (a) Project identification
- (b) Dates of testing
- (c) Table and a plan view of each shaft tested with accurate identification of tube coordinates and tubes referenced to the site
- (d) Tube collar elevation
- (e) Names of personnel that performed the tests/interpretation and their affiliation
- (f) Equipment used
- (g) Data Logs, interpretation, analysis, and results.

(a)

The Data logs for each tube pair tested with analysis of the initial pulse arrival time, velocity, relative pulse energy/amplitude, and stacked waveform plotted versus depth. List all zones defined by the Concrete Condition Rating Criteria (CCRC) in a tabular format including the percent velocity reduction and the velocity values used from the nearby zone of good quality concrete. Discuss each zone defined by the CCRC in the CSL report as appropriate. Base the results on the percent reduction in velocity value from a nearby zone of good quality concrete with good signal amplitude and energy as correlated to the following:

(b) Concrete Condition Rating Criteria (CCRC)		
(c) CCRC (d) (Rating Symbol)	(e) Velocity Reduction	(f) Indicative Results
(g) Good (G)	(h) $\leq 10\%$	(i) Good quality concrete
(j) Questionable (Q)	(k) 10 % to < 20 %	(l) Minor concrete contamination or intrusion. Questionable quality concrete.
(m) Poor/Defect (P/D)	(n) $\geq 20\%$	(o) Defects exist, possible water/slurry contamination, soil intrusion, and/or poor quality concrete.
(p) Water (W)	(q) V = 4750 fps (r) (1450 mps) (s) to 5000 fps (t) (1525 mps)	(u) Water intrusion or water filled gravel intrusion with few or no fines present.
(v) No Signal (NS)	(w) No Signal Received	(x) Soil intrusion or other severe defect absorbed the signal (assumes good bond of the tube-concrete interface).

Do not grout the CSL tubes or perform any further work on the CSL tested drilled shaft until the Engineer determines whether the drilled shaft is acceptable. Perform tomography in order to further investigate and delineate the boundaries of any defective/unconsolidated zones with 20% or more reduction in velocity value as correlated to the CCRC. Process CSL data to construct easy to understand 2D/3D (2D cross-sections between tubes and 3D volumetric images for the entire shaft) color-coded tomographic images indicating velocity variations along the shaft. Location and geometry of defective/unconsolidated zones must be identified in 3D color images with detailed discussion in the CSL report.

Correction of drilled shaft defect:

When the field testing results or report determine that a defect is present, the Engineer will direct the Contractor to submit remedial measures for approval. No compensation will be made for remedial work or losses or damage due to remedial work of drilled shafts found defective or not in accordance with the drilled shaft special provision or the Plans. Modifications to the drilled shaft design or any load transfer mechanisms required by the remedial action must be designed, plans submitted sealed by an Illinois Licensed Structural Engineer, along with the design computations.

Access tube grouting:

After CSL test results have been reviewed and the Engineer has accepted the drilled shaft or approves grouting of the tubes, the tubes and any core holes shall be dewatered filled with a nonshrink grout according to Section 1024. Shafts with are not initially selected for CSL testing shall not be grouted until the results of the tested CSL test shafts have been reviewed and accepted.

Method of Measurement: This work will be measured per each shaft CSL tested. Access tubes installed and not utilized by the CSL testing equipment will not be included in the measurement of this item.

Basis of Payment. This work will be paid at the contract unit price per EACH for CROSSHOLE SONIC LOGGING. This payment will constitute full compensation for furnishing, installing, all access tubes, coring for debonded or clogged access tubes, equipment procurement, installation, testing, analysis, report, supplemental testing of grouting of access tubes, and drilled shaft repairs necessary.

TEMPORARY WOOD POLE, 60 FT., CLASS 4

Description. This item shall consist of furnishing and installing a temporary wood pole, as specified herein and all hardware and accessories required for the intended temporary use of the pole.

Materials. Materials shall be according to the following Articles of Section 1000 - Materials

Item	Article/Section
(a) Wood Pole.....1069.04

CONSTRUCTION REQUIREMENTS

Installation. Installation shall be as described in Article 830.03(c). The Contractor shall provide all hardware to install the pole as specified herein and indicated on the plans.

Wood poles may be used poles as approved by the Engineer as described in Article 830.04. The wood pole, as applicable, shall remain the property of the Contractor and shall be removed when directed by the Engineer.

Method Of Measurement. Wood poles shall be counted as, each installed.

Basis Of Payment. This item shall be paid at the contract unit price each for TEMPORARY WOOD POLE, of the class and length indicated.

CONSTRUCTION VIBRATION MONITORING

Description. This work consists of monitoring buildings susceptible to movement. Additional monitoring of facilities may be required and these will be determined by the Engineer during the work. This additional monitoring is included in this item. The Contractor shall monitor adjacent buildings for both vibration and displacement. The Contractor shall designate a minimum of two monitoring point locations for each of the structures located at 400 South Green Street (Green Street Lofts), 815 West Van Buren Street (Rice Building), 411 South Sangamon Street (Sangamon Lofts), 933 West Van Buren and 412 South Peoria Street (UIC CUPPA Hall Building). The monitoring point locations shall be spaced as evenly as possible along the building edge at the interface between the bridge and the building properties. The monitoring points for vibration and displacement do not have to be at the same location. The Contractor shall coordinate with the Engineer and building owners to ensure the proposed monitoring locations are acceptable to the building and accessible to both the Contractor and the Engineer. Proposed locations of building vibration and displacement monitoring points are to be submitted to the Engineer for approval prior to construction.

CTA Track Monitoring; The Contractor will include monitoring of the eastbound and westbound CTA tracks below and adjacent to a portion of construction in the contract. The Contractor will monitor CTA tracks for vertical and horizontal movements. As a minimum, monitor daily from start of demolition through completion of new bridge structure installation, then weekly through project completion. Submit copies of reports to CTA for review. The reports shall identify monitoring instrumentation utilized, measurement data, stop work periods, corrective measures and other associated information. Maximum allowable horizontal and vertical movements are $\frac{1}{4}$ inch. If movements in excess of $\frac{1}{4}$ inch are detected, the Contractor will discontinue construction operations immediately and notify the CTA. CTA will evaluate the track condition and determine what restorative work is required. The Contractor will perform this restorative work at the Contractor's expense prior to continuing remaining contract work. If track repairs are required, the Contractor shall hire a Contractor experienced in CTA track work and approved by the CTA to perform the corrective repairs to the satisfaction of the CTA.

Vibration Monitoring: The Contractor shall employ the services of a seismic monitoring consultant as approved by the Engineer. Monitoring point locations and frequency of data collection shall be as determined by the Contractor's Consultant and are subject to the approval of the Engineer. All vibration monitoring devices (seismographs) shall be attached to the floor of the buildings they are monitoring. The limit of acceptable vibration (Limiting Value) at structure shall be 0.5 in/s (inches per second) peak particle velocity. The Contractor's consultant may propose a Threshold Value of vibration for Engineer's review. When the Threshold Value is reached, the Contractor must stop the work and meets with the Engineer to determine the best course of action to reduce the vibrations (or minimize further displacement). Once the Limiting Value is reached, the work is stopped and a more formal response plan is submitted for approval before work can proceed. All seismographs on the project shall be programmed to actuate an alarm when the Threshold Value is exceeded. The alarm notification protocol shall consist of immediate dialing of mobile telephone numbers of the Engineer and the Contractor.

If the Limiting Value is exceeded, all vibration inducing work within 100 feet of the existing building shall be stopped. Work may resume at the direction of the Engineer with the Contractor continuing to closely monitor vibration in the area of the alarm. If the work is stopped because the Limiting Value is exceeded there will be no additional compensation nor any additional time extensions granted. Any change in construction methods to avoid exceeding Limiting Value will not be grounds for additional compensation.

Displacement Monitoring: The Contractor shall provide the exact horizontal and vertical location of the displacement monitoring points to the Engineer prior to the commencement of any construction activities. The data shall be presented in a tabular format and shall include horizontal positions (stations and offsets or Northing and Easting) as well as vertical elevation (Chicago City Datum) to a minimum of one hundredth of a foot (0.01').

Monitoring Frequency: During the beginning phase of each stage of demolition and construction, displacement monitoring shall be performed at the beginning and end of each work day at a minimum. These surveying intervals are the minimum required, and more frequent monitoring may be required by the Engineer as field conditions warrant.

If after a period of time resulting in movements that are small in magnitude, monitoring frequency can be reduced to a frequency as established by the Engineer. If resulting movements become random in nature and/or large in magnitude, the frequency shall be increased as directed by the Engineer. The frequency of readings will be dictated by the phase of current construction but must be sufficient to detect serious movements so that corrective measures can be initiated immediately.

Monitoring readings for displacement shall be dated, recorded, and reported to the Engineer the same day the readings are taken.

Vibration monitoring shall be a continuous and uninterrupted process. During demolition within 50 feet of a vibration monitoring point location, the Contractor shall report the results of the largest amplitude of vibration to the Engineer on the same day. At all other times the vibration report shall be submitted weekly.

Construction Requirements. Before the start of construction, the Contractor will complete a preconstruction inspection of 400 South Green Street (Green Street Lofts), 815 West Van Buren Street (Rice Building), 411 South Sangamon Street (Sangamon Lofts), 933 West Van Buren and 412 South Peoria Street (UIC CUPPA Hall Building). Before the start of construction, the Contractor will complete a preconstruction inspection of the existing buildings listed above. Readily visible conditions and distress such as unusual cracks in concrete or masonry, obvious signs of leakage, settlement, etc. will be photographically recorded and documented. The Contractor will also make a DVD survey to provide a more complete general record of conditions in those areas. The interior survey shall include the first floor and basement (if existing) within 30 feet of the exterior wall closest to the project site. The exterior survey will include the exterior wall closest to the project site and the two adjacent walls. The survey will be performed from grade without the use of magnification devices. At the conclusion of the preconstruction field work, a report shall be prepared by the Contractor presenting the observed existing conditions and shall include written, videotaped and photographic documentation. This record shall then be used by the Contractor as a basis for comparison to distresses that may occur after the survey. The locations of the displacement monitoring points shall be included in the Report.

The Contractor will use the preconstruction report to aid in the selection of the displacement monitoring points. The Contractor must devise means and methods of construction that will not exceed the specified vibration limits. The Contractor is advised that particularly careful demolition requirements will be required at the edges of the bridge where the property line is immediately adjacent to the area of construction.

Corrective Measures. If at any time resulting movements are serious in nature or cause damage to facilities or property, the Contractor shall stop work immediately and the necessary corrective measures shall be initiated as directed by the Engineer. Damage as a result of the work activity of the Contractor will be corrected by the Contractor as determined by the Engineer. No additional compensation will be due the Contractor for repairing these facilities. The Contractor will not be entitled to any claim of delay for stopping of working to make correct measures.

Submittals. The Contractor must submit a Vibration and Displacement Control Plan to the Engineer for Approval. The Plan must be approved prior to the commencement of work. The plan must include, but is not limited to the following:

- Locations of all monitoring points (Vibration and displacement).
- Procedure and outline for how the data will be provided to the Engineer.
- Type of seismograph to be used (Submit to Engineer for Approval).
- List of pneumatic equipment to be used during demolition operations.
- Contact information for the Seismic Monitoring consultant.
- Timetable that outlines the duration that each monitoring point will be maintained and checked.

A "Response Plan" to detail how the Contractor will address any concerns with vibration or displacement.

Additional Submittals include:

- Daily reports of all displacement monitoring
- Weekly reports of all vibration monitoring

Method of Measurement. The work under this item as described herein will not be measured separately. It will be paid for as lump sum.

Basis of Payment. This work will be paid at the contract unit price per lump sum for CONSTRUCTION VIBRATION MONITORING which payment shall be full compensation for the work described herein and as directed by the Engineer.

COMBINED SEWER REMOVAL

Description. This work will consist of the removal of combined sewers, including laterals.

Combined sewers shall be removed according to Article 551.03 of the "Standard Specifications".

This work includes the removal of the existing 54" concrete siphon pipe. The contractor tasked with removing the 54" concrete siphon pipe shall coordinate this work with the contractor removing the existing siphon outlet junction chamber and the rest of the siphon reconstruction work. In addition, due to the fact that the flow through the siphon will need to be maintained throughout construction it is very important that the contractor performing this work coordinate with the contractor constructing the temporary soil retention systems.

Method of Measurement. This work shall be measured for payment according to Article 550.09 of the "Standard Specifications".

Excavation in rock will be measured for payment according to Article 502.12

Trench backfill for combined sewer removal will be measured for payment according to Article 208.03, except an addition will be made for one-half of the volume of the pipe removed.

Basis of Payment. This work will be paid for at the contract unit price per foot for COMBINED SEWER REMOVAL, of the diameter specified. TRENCH BACKFILL will be paid for separately.

Excavation in rock will be paid for according to Article 502.13.

Trench backfill will be paid for according to Article 208.04.

Removal and replacement of unsuitable material below plan bedding grade will be paid for according to Article 109.04.

MAINTAINING ITS DURING CONSTRUCTION

Description. Intelligent Transportation Systems (ITS) references IDOT traffic surveillance infrastructure. These elements include, but are not limited to, the following: induction loops, ramp meters, closed circuit television cameras, dynamic message signs, highway advisory radios, Radar Vehicle Sensing Device (RVSD), copper and fiber optic communication cables, power cables, cabinets, and communication equipment.

General Requirements. Effective the date the Contractor's activities (ITS or otherwise) at the job site begin, the Contractor shall be responsible for the proper operation and maintenance of ITS elements which are part of, or which may be affected by the work until final acceptance or as otherwise determined by the Engineer.

Before performing any excavation, removal, or installation work (ITS or otherwise) at the site, the Contractor shall initiate a request for a maintenance transfer and preconstruction inspection, to be held in the presence of the Engineer and a representative of the party or parties responsible for maintenance of any ITS systems which may be affected by the work. The request for the maintenance preconstruction inspection shall be made no less than seven (7) calendar days prior to the desired inspection date.

Existing ITS elements, when depicted on the plans, are intended only to indicate the general equipment installation of the systems involved and shall not be construed as an exact representation of the field conditions. It remains the Contractor's responsibility to visit the site to confirm and ascertain the exact condition of the ITS components and systems to be maintained.

Existing ITS components shall be defined as any ITS component or device in service at the time of the commencement of construction activities. The contract drawings indicate the general extent of any existing ITS elements, but whether indicated or not, it remains the Contractor's responsibility to ascertain the extent of effort required for compliance with these specifications, and failure to do so will not be justification for extra payment or reduced responsibilities.

Maintaining ITS During Construction - The Contractor's responsibility shall include protecting in place any cables, conduits and ITS devices in or adjacent to the work zone. The Contractor shall coordinate maintaining ITS activities with adjacent IDOT projects.

Rerouted ITS Communication Cables - The Contractor is responsible for maintaining the fiber and copper communication cables that have been rerouted from the median barrier wall by others. This existing communication and infrastructure must be properly maintained for the duration of construction activities. During pier removal and reconstruction activities, the Contractor will be responsible for maintaining the rerouted ITS cables through the work zone. This may require the Contractor to detach the conduit from the barrier wall or other structure and protect in place during pier removal and reconstruction activities. Slack has been provided in the rerouted cables to facilitate this. The Contractor is responsible for reattaching the conduit to the median barrier or other structure, as necessary, on the CTA side of the barrier once pier removal and reconstruction activities are complete.

All work required to maintain ITS infrastructure as depicted in the plans or otherwise necessary and as provided for in this special provision shall be paid for under the Maintaining ITS During Construction pay item. No component items germane to this work shall be paid for separately.

Method of Measurement. The Contractor shall demonstrate to the satisfaction of the Engineer that the ITS components or devices have been properly protected prior to submitting a pay request. In order for final payment to be released the Contractor must demonstrate that the equipment is working as intended following inspection by the Engineer. Failure to do so will be grounds for denying the pay request.

Basis of Payment. Maintenance of ITS components and devices during Construction shall be paid for at the contract unit price per calendar month (Cal Mo) for MAINTAINING ITS DURING CONSTRUCTION, which shall include all work as described herein.

UNDERGROUND CONDUIT, SCHEDULE 80 (CDOT)

Description. This work will consist of furnishing and installing a conduit lateral of the type and size specified.

Materials. Polyvinyl chloride (PVC) conduit must conform to the requirements of Material Specification 1533 and to the requirements of the National Electrical Manufacturers Association Standard, Publication Number TC2 for EPC-80. Conduit color will be determined by the Resident Engineer.

Construction.

Definition of Laterals. A lateral will mean a conduit raceway extending from one sub-surface location to another sub-surface location, and in every case intended to encase electric circuit cable under paved surfaces, or in unpaved parkway, street or alley, where specifically designated.

Locations. Laterals must be installed at the locations shown on the construction plans. Laterals must be installed in the shortest practicable line between points of termination, or under adverse conditions, as directed by the Resident Engineer. Laterals not shown on the drawing, but necessary to be installed will be paid for at the unit price bid for laterals as additional units of construction.

Installation Requirements. The Contractor must exercise care in installing the conduit to ensure that it is smooth, free from sharp bends or kinks, and has the minimum practicable number of bends. Crushed or deformed conduit will not be accepted. All conduit and fittings must have the burrs and rough places smoothed, and all conduit runs must be cleaned and swabbed before installation of electric cables. If cable is not to be installed immediately after cleaning of the conduit, a light weight pulling line such as 1/8" polyethylene line must be placed in the conduit and will remain in the conduit for future work. All underground conduits must have a minimum cover of thirty inches (30") below grade. If conduit cannot be installed with a minimum cover of thirty inches (30"), the conduit must be encased in concrete for protection. The method of encasement and protection must be approved by the engineer. Concrete encasement will be paid for as a separate pay item.

When multiple laterals in a common trench are required, no more than three (3) three inch (3") or smaller conduit laterals can be laid on a single, horizontal level. Four or more conduit laterals must be installed on two (2) levels in accordance with instructions of the Resident Engineer.

Conduit laterals installed under vaulted walks must be securely attached to the retaining wall by means of galvanized clamps and clamp backs held in place by anchor bolts. Laterals will be fastened as close to the underside of the sidewalk as possible, and securing clamps installed every five feet (5'). Laterals must be continuous through party walls.

Threaded fittings and bends of the same material as conduit must be furnished and installed as required. Threadless couplings may be used only for splicing existing conduit. All conduit splices, where required, will be considered incidental to this pay item.

Method of Measurement. The length measured will be the number of lineal feet of conduit installed and accepted, measured in place. The length for measurement will be the distance horizontally between changes in the direction of the conduit.

Basis of Payment. This work will be paid for at the contract unit price per lineal foot for UNDERGROUND CONDUIT of the type and size as specified, SCHEDULE 80 (CDOT), which price will be payment in full for furnishing and installing the conduit and fittings complete. Cleaning, swabbing, and p-lining of new conduit will be incidental to this pay item.

COMBINED SEWER (EXTRA STRENGTH VITRIFIED CLAY PIPE) (CDOT)

Description. Work under these items shall be performed according to Section 550 of the IDOT Standard Specifications and the current City of Chicago Department of Water Management (DWM) Regulations for Sewer Construction and Stormwater Management and DWM Standard Specifications for Water and Sewer Main Construction, except as herein modified.

This work shall consist of constructing combined sewers at locations designated by the Engineer, including any dewatering, sheeting and/or shoring required to perform the work as specified.

Materials. Materials shall be per the most current DWM Standard Specifications for Water and Sewer Main Construction:

Construction Requirements. Where a sewer or drain connection is to be made to a proposed E.S.V.C.P. storm sewer a manufactured Y or T branch pipe shall be installed in the sewer at this junction.

Where a sewer or drain connection is to be made to a proposed R.C.P. sewer a pipe section with a predrilled hole of the proper diameter shall be installed at this junction.

Where a sewer or drain connection is made to an existing sewer, a "T" or "Y" saddle shall be installed. The circular opening in the existing sewer must be core drilled to the same size as the external diameter of the proposed or drain connection. The protrusion of the proposed sewer into the existing sewer must not exceed a maximum of 1 inch. Edge of core holes must be a minimum of 1.5 feet from the edge of pipe and a minimum distance of 5 feet horizontally between holes. Do not drill holes higher than 10 and 2 o'clock.

QC/QA Requirements.

The Contractor must provide a Manufacturer's written certification that the materials comply with these specifications. All sewers and sewer structures must be inspected prior to the final payment to the Contractor.

Method of Measurement. This work will be measured for payment in place per foot.

Basis of Payment. This work will be paid for at the contract unit price per foot for the COMBINED SEWER (EXTRA STRENGTH VITRIFIED CLAY PIPE) of the diameter specified of the type, diameter, and material specified (CDOT).

Trench backfill will be paid for according to Article 208.04.

COMBINED SEWER ADJACENT TO OR CROSSING WATER MAIN

Description. This work consists of constructing combined sewer adjacent to or crossing a water main at the locations shown on the plans. The material and installation requirements shall be according to the latest edition of the "Standard Specifications for Water and Sewer Main Construction in Illinois", "City of Chicago Department of Water Management (DWM) Regulations for Sewer Construction and Stormwater Management", "City of Chicago DWM Standard Specifications for Water and Sewer Main Construction", and the applicable portions of Section 550 of the Standard Specifications; which may include concrete collars and encasing pipe with seals if required.

Pipe materials shall meet the requirements of Sections 40 and 41-2.01 of the "Standard Specifications for Water and Sewer Main Construction in Illinois" and the current "City of Chicago DWM Standard Specifications for Water and Sewer Main Construction", except PVC pipe will not be allowed. Ductile-Iron pipe shall be required and shall meet the minimum requirements for Thickness Class 50.

Method of Measurement. Sewers installed adjacent to or crossing water main shall be paid for per foot for COMBINED SEWER (WATER MAIN REQUIREMENTS), of the diameter specified CDOT.

Basis of Payment. This work will be paid according to Article 550.10 of the Standard Specifications, except the pay items shall be COMBINED SEWER (WATER MAIN REQUIREMENTS), of the diameter specified CDOT.

COMBINATION CURB AND GUTTER TYPE B V.12 (CDOT)

Description: Work under this item shall be performed according to Section 606 of the IDOT Standard Specifications for Road and Bridge Construction, and to the City of Chicago Department of Transportation Regulations for Openings, Construction and Repair in the Public Way. The work consists of constructing variable height Portland Cement Concrete (PCC) combination curb and gutter greater than 3" in height and less than 9" in height.

Materials: Materials shall meet the applicable requirements of Division 1000 of the Standard Specifications.

Construction Requirements: Meet applicable requirements of Section 606 of the Standard Specifications. Construct combination concrete curb and gutter type B V.12 (CDOT) at the locations, widths and thickness shown on the Plans.

Method of Measurement: COMBINATION CURB AND GUTTER TYPE B V.12 (CDOT) will be measured for payment in feet along the flow line of the gutter and along the face of the concrete curb, which measurement will include drainage castings incorporated in various curbs and gutters.

Basis of Payment: This work will be paid for at the contract unit price per foot for COMBINATION CURB AND GUTTER TYPE B V.12 (CDOT).

SAND CUSHION, 4 INCH, (CDOT)

Description. Work under this item shall be performed according to Section 311 of the IDOT Standard Specifications for Road and Bridge Construction, except as herein modified.

This work shall consist of coarse sand placement of 4" depth beneath proposed sidewalks, driveways, or other appurtenances as directed by the Engineer.

Materials. Materials shall be a fine aggregate meeting the requirements of Article 1003.04.

General Requirements. If unstable or unsuitable subbase conditions are encountered after excavation to proposed subbase elevations, the Engineer may require removal and replacement of this unsuitable material with coarse sand placement.

Construction Requirements. The method for placement and compaction of the coarse sand shall be to the satisfaction of the Engineer.

Method of Measurement. This work will be measured for payment in place in square foot.

Basis of Payment. This work will be paid for at the contract unit price per square foot for SAND CUSHION, 4 INCH, (CDOT).

CLEAN MANHOLE OR HANDHOLE

Description. This item consists of cleaning an existing handhole or manhole for the installation of new conduit(s) and cable(s).

General Requirements. General requirements must be in accordance with Section 801 of the Standard Specifications, and in accordance with Bureau of Electricity Standards and the City of Chicago Electrical Code, except as herein modified.

Installation. Existing cable hooks must be relocated and existing cables must be retrained as required prior to drilling the existing manhole or handhole. Existing and new debris must be removed and disposed of off-site by the Contractor. Existing and new gas and water must be pumped out as directed by the Commissioner. Debris removal, de-gassing and water pumping must be included in this item; separate payment will not be made.

The Contractor must furnish and install cable racks and/or cable hooks for new and existing cables in all manholes and handholes as required to facilitate new cable installation. This Work must be included in this item and separate payment will not be made.

Coordination with ComEd for ComEd handholes or manholes, and coordination with the Bureau of Electricity for city electric handholes or manholes must be performed by the Contractor prior to starting any Work. Coordination must be included in this item; separate or additional payment will not be made.

Drilling the existing manhole or handhole will not be included in this item and will be paid for under a separate pay item.

Method of Measurement. Each manhole or handhole that is cleaned (relocating existing cable hooks, installing new cable hooks, retraining cables, removing debris, and pumping out gas and water) as indicated will be counted as a unit for payment. Each manhole or handhole that is drilled will be measured for payment for cleaning, and will be measured for cleaning only once.

Basis of Payment. This work will be paid for at the contract unit price each for CLEAN MANHOLE OR HANDHOLE (CDOT), which will be payment in full for performing the work described herein.

CONCRETE CURB, TYPE B (SPECIAL) (CDOT)

Description: Work under this item shall be performed according to Section 606 of the IDOT Standard Specifications for Road and Bridge Construction and to the City of Chicago Department of Transportation Regulations for Openings, Construction and Repair in the Public Way. The work consists of constructing variable height Portland Cement Concrete (PCC) curb greater than 3" in height and less than 9" in height.

Materials: Materials shall meet the applicable requirements of Division 1000 of the Standard Specifications.

Construction Requirements: Meet applicable requirements of Section 606 of the Standard Specifications. Construct concrete curb, type B (special) (CDOT) at the locations, widths and thickness shown on the Plans.

Method of Measurement: CONCRETE CURB, TYPE B (SPECIAL) (CDOT) will be measured for payment in feet along the face of the concrete curb, which measurement will include drainage castings incorporated in various curbs and curbs and gutters.

Basis of Payment: This work will be paid for at the contract unit price per foot for CONCRETE CURB, TYPE B (SPECIAL) (CDOT).

DETECTABLE WARNINGS (SPECIAL)

Description: Work under this item shall consist of installing cast iron detectable warning tiles on ADA curb ramps as shown on the plans and according to the latest Chicago Department of Transportation ADA Standards. Work shall be performed according to Section 424 of the IDOT Standard Specifications for Road and Bridge Construction, except as herein modified.

Materials: Detectable warning tiles shall be cast gray iron and shall be provided by a Manufacturer approved by the City of Chicago Department of Transportation. A list of approved Manufacturers of cast iron detectable warning tiles is available on the City of Chicago Department of Transportation website under Construction Guidelines/Standards.

The cast iron detectable warning tiles shall be of uniform quality, free from surface defects and shall be provided with an untreated, natural surface finish as directed by the Engineer. All detectable warning systems shall be of the linear type.

Construction Requirements: The detectable warning system shall be installed in fresh concrete and shall comply with the City of Chicago Department of Transportation Regulations for Openings, Construction and Repair in the Public Way, Appendix B, ADA Standards. The equipment and installation procedures shall be according to the Manufacturer's specifications.

The Contractor shall install the detectable warning system flush with adjacent concrete, and resulting in a snug fit between tiles to limit water infiltration around the perimeter of the system and between tiles, as directed by the Engineer.

QC/QA Requirements: A Manufacturer's written certification that the material complies with these specifications shall be provided to the Engineer.

Method of Measurement: This work will be measured for payment in place in square feet.

Basis of Payment: This work will be paid for at the contract unit price per square foot for DETECTABLE WARNINGS (SPECIAL).

FOUNDATION REMOVAL

Description. Work under this item shall consist of furnishing all labor, equipment, tools, excavation and backfill, required to remove and dispose of existing foundations that impact proposed bridges, retaining walls, roadway drainage, roadway subbase, and any other proposed project elements within the project limits. Existing foundations are expected to consist of reinforced or unreinforced concrete, rock and may include steel or timber piles. This work shall be performed accordance with the applicable portions of Section 501, 502, and 516 of the Standard Specifications, except as herein modified. The foundations are identified within the plans as Abandoned CTA Foundations.

General Requirements. Record drawings indicate that all or portions of abandoned foundations may be encountered as part of proposed work. These foundations previously were part of an elevated transit rail line constructed in the 1890's and demolished during or after 1958. The foundations may have been left in place during the initial construction of the westbound Interstate 290 and associated improvements at that time. All work shall be performed as shown on the contract plans and as directed by the Engineer. The size and dimensions of the foundations expected to be removed as part of this work are included in the plans. Locations of existing foundations are included in the plans and have been estimated based upon record drawings only. No survey or exploration to identify abandoned foundations has been undertaken.

Construction Requirements. The work shall conform in every respect to all environmental, state and local regulations regarding construction requirements, the protection of adjacent properties and as noise control.

The Contractor may elect to use Ground Penetrating Radar or other means, as approved by the Engineer, to determine the location of foundations in advance of excavation activities. These exploration efforts will not be paid for separately.

Any existing foundations that are identified to exist, but are determined to not impact the proposed improvements described in the plans and verified by the Engineer, are not required to be removed and work to remove these foundations will not be paid for.

The Contractor shall submit a list of equipment and methods he proposes to use for the removal and disposal of the existing foundations to the Engineer for review. The Contractor shall submit a plan for approval that includes all locations determined to have anticipated foundations requiring removal prior to beginning work to remove foundations. If a previously unidentified foundation is uncovered during the execution of excavation activities described in other sections of these specifications, the Contractor shall identify foundation to the Engineer prior to beginning removal activities.

All materials removed under this item shall become the property of the Contractor and shall be disposed of by the Contractor according to Article 202.03 of the Standard Specifications.

Method of Measurement. This work will be measured for payment for the complete foundation that is removed and disposed of as required.

Basis of Payment. The cost of foundation removal will be paid for per unit price, each instance of foundation that requires removal at the contract unit price for FOUNDATION REMOVAL. This includes all exploration, excavation, concrete removal, pile extraction, disposal, back fill of excavated areas, flowable fill placement, aggregate placement and any other impacts of the foundation removal. Any excavation beyond the limits of improvements described in the plans will not be paid for, and are not included within the work for foundation removal.

BRIDGE FENCE RAILING (SPECIAL)

The fence railing shall conform to Section 503 and 509 of the Standard Specifications except as herein modified.

Description. This Work consists of furnishing and installing decorative fence system of the type specified at locations shown on the Plans or directed by the Engineer, and in accordance with the details shown in the Plans.

Materials. T316 stainless steel.

Finish. Wire mesh frame, supports, attachment tabs, fence posts and exposed base plates shall have matt, non-directional surface, EN 10088-2 2K, maximum surface roughness of 0.5 Microns Ra. Wire mesh shall have surface finished as supplied by approved manufacturer.

Pickled and passivated process shall be used to remove all discoloration after fabrication for the entire fence rail system, including but not limited to mesh panels, posts, mounting tabs and anchor plate, per ASTM A380 and ASTM A967.

General. Mesh panels shall be framed with angle iron frames, mechanically attached to posts with angle iron mounting tabs. Wire mesh shall be welded to the backside of the angle iron frames with exposed welds. Frame supports shall be welded to back side of angle iron frame. Mounting tabs shall have slotted holes that mate with mounting holes on the mesh panel and shall be welded to posts.

Fence post carrying the mesh panels shall be normal to the parapet. The top and bottom of the mesh frame shall be parallel to grade line and top of bridge parapet.

Submittals.

1. Manufactures' certification that stainless steel fence and connections meet IDOT and CDOT specifications.
2. Shop drawings including bridge parapet wall with the Chicago Pattern, railing and fencing system.
3. Samples of manufacturer's available surface finishes.
4. Sample of fence components, including mesh, 6" long sections of angle iron frame, posts and full size mounting tab. Samples to have the specified finish.
5. Manufactures' certificate of achieving the specified surface finish.
6. Mockup of mesh panel and post tested for required loads, and delivered on the site for appearance approval.
7. Calculations signed and sealed by an Illinois Registered Structural Engineer.

Coordination: Coordinate with Chicago Wall concrete barrier manufacturer, rail manufacturer, electrical and traffic surveillance requirements to install conduit and junction boxes.

Complete shop drawings and calculations by an Illinois Registered Structural Engineer, and field installation drawings must be submitted to the Engineer for approval prior to ordering materials, commencement of any shop fabrication, and/or finishing.

Stainless Steel Bridge Fence. The stainless steel system must be in accordance with the Plans and with AASHTO-AGC-ARTBE Joint Committee Task Force 13 Report "A Guide to Standardized Highway Barrier Hardware."

There will be a single source responsibility for the stainless steel mesh panel, which will include but not be limited to the stainless steel mesh, frame, intermediate support, finishing the product, structural calculations, bolts, fasteners, welding, shop fabrication, field erection, and freight etc. The rest of the system, including but not limited to attachment of the mesh panel to posts, bolts, studs, and required embedment must be responsibility of by the Contractor.

Design Requirements: The design requirements must be as set forth in the AASHTO Task Force 13 Report ("A Guide to Standardized Highway Barrier Hardware").

All fasteners and bolts must be stainless steel.

Structural Requirements: The bridge fence system must conform to the requirements of AASHTO "Standard Specifications for Highway Bridges" Section 2.7.

All thickness and material specifications requirements, unless otherwise approved by the Engineer, must be based on certifications based on structural calculations provided by the Contractor.

Stainless Steel Wire Mesh. Large scale, three wire, rigid cable. Percent open shall be minimum 62%. Maximum sphere diameter opening: 1 3/4". Min wire diameter shall be 0.162. Triple wire groups shall run horizontally.

Acceptable wire mesh panel manufacturer:

1. Banker Wire
2. Cambridge Architectural
3. GKD Metal Fabrics
4. Approved Equal.

Acceptable wire mesh product:

1. Banker Wire Architectural Mesh Pattern: M13Z-7
2. Approved Equal

Method of Measurement. This Work will be measured for payment, complete in place, per foot measured along the top of the fence railing.

Basis of Payment. This Work will be paid for at the Contract Unit Price per foot for BRIDGE FENCE RAILING (SPECIAL), which price includes furnishing and placing all material required, including all labor, equipment and incidentals necessary to complete the Work as herein specified.

TREE GRATES

Description. This work consists of furnishing and installing tree grates and frames as shown on the plans or as directed by the Engineer. Work under this item must conform to the requirements of applicable portions of the Standard Specifications.

General Requirements.

Material. The material must be gray iron castings conforming to A.S.T.M. A48 or A-48-75, class 35 or 35B, and Article 1006.14 of the Standard Specifications. Concrete must be Class SI and conform to the requirements of Section 1020 of the Standard Specifications.

Design. Grate pattern must comply with ADA Guidelines for equal access. Tree grates will be 1.5" thick with accompanying frame. Grate will consist of two halves with 24" minimum diameter opening for trees. Retrofit grates will be 1.5" thick with a $\frac{3}{4}$ " thick lip extending 2" beyond the edge of the tree pit opening. Grate openings must meet or exceed ADA Standard. Grate dimensions will be specified in plans or by the Engineer. Grate halves must be able to be bolted together with tamperproof bolts, and the grate must also be bolted to the frame with tamperproof bolts.

Frame. Frame must be 1 $\frac{3}{4}$ " x 1 $\frac{3}{4}$ " x $\frac{1}{4}$ " steel frame, or must coordinate with grate dimensions, surrounding the entire perimeter of the tree pit. Frame must be manufactured with anchor tabs for concrete installation.

Finish (applies to all tree grates, new and retrofit)

1. Surface Preparation :
The top surface must be cleaned in accordance with Section 506 of the Standard Specifications for Method 2 (power or hand tool cleaning) and must be free of all loose rust and loose mill scale.
2. Coating:
Before installation, in an effort to reduce the appearance of oxidation, all surfaces (top, bottom and edges) of the grates are to be coated and rubbed with two applications of a Type 1 Membrane Curing Compound meeting the requirements of Article 1022.01 of the Standard Specifications, or alternative compound as approved by the Engineer.

Surface preparation and coating will not be measured and paid for separately but will be included in the cost of all items listed herein.

Shop Drawings. Shop drawings of all items related to the manufacture and installation of the tree grate and frame must be submitted and approved by the Engineer before fabrication.

Manufacturer. Tree grates can be supplied by the following suggested manufacturers:

1. Neenah Foundry, Neenah, Wisconsin
2. Urban Accessories, Woodinville, WA
3. Ironsmith, Palm Desert, CA
4. Fairweather/Olympic Foundry, Seattle, WA)
5. Approved Equal

And must match in similarity the following Neenah tree grate style; (square)R-8713.

Fasteners. Tree grate halves must be joined together with tamper resistant bolts and fastened to grate frame with tamper resistant bolt assembly packages as provided by the manufacturer.

Inspection. Installation assumes responsibility for performance.

Surface conditions. Examine frame, concrete ledge, or ground surface to receive grate. The seat for the grates must be cleaned prior to setting the grates. Correct conditions to comply with manufacturer's recommended installation procedures.

Opening to receive grates. SAND CUSHION, 4 INCH (CDOT) must be placed and compacted to 95% proctor prior to installation of frame. Frame will then be placed on top of compacted sand cushion surface. Wood forms must be placed inside frame to prevent concrete seepage into pit area, and expansion joints place on the outside of the frame. PORTLAND CEMENT CONCRETE SIDEWALK 5 INCH will then be poured around frame, and allowed to set until firm. The installation of SAND CUSHION, 4 INCH (CDOT) and PORTLAND CEMENT CONCRETE SIDEWALK 5 INCH will be paid for separately.

When installing grate at the back of curb, a C-channel must be installed at the curb to accept tree grate frame. Hilti-type Anchoring system for C-channel must have a minimum shear capacity of 12 kips live wheel load. Detailed product information must be submitted for approval prior to installation.

Join Grate Halves. Bring tree grate halves together around tree at a level to allow easy access to underside. Join sections at preformed holes using temper-resistant bolt packages provided by manufacturer as suggested. Lower grate into place and bolt to frame with tamper-proof resistant bolts. If grate manufacturer cannot accomplish this, then the grates and frame must be tapped, field drilled, and bolted on site. The cost for this work and equipment will be incidental to these items.

Warranty. Manufacturer's written warranty must be handed over to the Engineer prior to installation of grates.

Material under Grate. Mulch shall follow the requirements of the special provision MULCH.

Method of Measurement. TREE GRATES will be measured for payment per each, complete in place.

Basis of Payment. The work under this item will be paid for at the contract unit price per each for TREE GRATES which price will include all labor, materials and equipment necessary to install the tree grates and frames as shown on the plans.

WATER MAIN REMOVAL

Description. This work will consist of the removal of water main of various sizes and all bends, fittings and all other appurtenances.

Water main shall be removed according to Article 561 of the "Standard Specifications" and in conformance with the methods identified in Article 551.03 of the "Standard Specifications"

Method of Measurement. This work shall be measured for payment according to Article 561.04 of the "Standard Specifications".

Any reducer pipe sections will be measured as the pipe size of the larger opening.

Water main within a vault structure to be removed will be considered a part of the vault structure unless the vault is easily removed around the pipe and the pipe can be removed as part of the removal of adjacent pipe.

Excavation in rock will be measured for payment according to Article 502.12.

Trench backfill for water main removal will be measured for payment according to Article 208.03, except an addition will be made for one-half of the volume of the pipe removed.

Basis of Payment. This work will be paid for at the contract unit price per foot for WATER MAIN REMOVAL, of the diameter specified. TRENCH BACKFILL will be paid for separately.

Excavation in rock will be paid for according to Article 502.13.

Trench backfill will be paid for according to Article 208.04.

Removal and replacement of unsuitable material below plan bedding grade will be paid for according to Article 109.04.

INLETS (CITY OF CHICAGO)

Description. Work under this item shall be performed according to Sections 602 and 604 of the IDOT Standard Specifications for Road and Bridge Construction and the current City of Chicago Department of Water Management Standard Specifications for Water and Sewer Main Construction, except as herein modified. Inlets shall be constructed as per City of Chicago Department of Water Management Standard A.16 (Standard Inlet – 2' Dia.) as shown in the plans.

Materials. Materials shall be according to the following:

- (a) Coarse aggregate for bedding material shall meet a CA 11 gradation in accordance with Article 1004.05 of the IDOT Standard Specifications.
- (b) Fine aggregate for backfilling material shall meet a FA 6 gradation in accordance with Article 1003.04 of the IDOT Standard Specifications.
- (c) City of Chicago standard frame and lid shall meet be in accordance with the City of Chicago Department of Water Management Standard Specifications for Water and Sewer Main Construction.

General Requirements. An ADA compliant open lid shall be placed on all inlets located within the cross walk or as directed by the Engineer.

Basis of Payment. This work will be paid for at the contract unit price per each for INLETS, of the type specified, type of frame and grate or type of frame and lid specified (CITY OF CHICAGO).

CATCH BASINS (CITY OF CHICAGO)

Description. Work under this item shall be performed according to Sections 602 and 604 of the IDOT Standard Specifications for Road and Bridge Construction and the current City of Chicago Department of Water Management Standard Specifications for Water and Sewer Main Construction, except as herein modified. Catch basins shall be constructed as shown in the plans.

Materials. Materials shall be according to the following:

- (a) Coarse aggregate for bedding material shall meet a CA 11 gradation in accordance with Article 1004.05 of the IDOT Standard Specifications.
- (b) Fine aggregate for backfilling material shall meet a FA 6 gradation in accordance with Article 1003.04 of the IDOT Standard Specifications.
- (c) City of Chicago standard frame and lid shall meet be in accordance with the City of Chicago Department of Water Management Standard Specifications for Water and Sewer Main Construction.

General Requirements. An ADA compliant open lid shall be placed on all catch basins located within the cross walk or as directed by the Engineer.

The City of Chicago Department of Water Management's (DOWM) Rain Blocker Restrictor Program shall be maintained with any roadway improvement. The restrictors shall be installed in all catch basins outside of the Central Business District. Restrictors must not be installed in catch basins in close proximity to viaduct areas, bus stops, or emergency entrances. The City of Chicago Department of Water Management (DOWM) must approve the non-installation or removal of any restrictor. The restrictors can be obtained from City of Chicago Department of Water Management Central District at 3901 S. Ashland Avenue. The Contractor should arrange for pick up by contacting 312-747-1177 (7am to 3pm, Monday to Friday). The furnishing and installing of a restrictor shall be included in the contract unit price for catch basins.

Requirements for restrictor installation are as follows:

- Arterial Streets: 3-inch Orifice Restrictor
- Bus Routes: 3-inch Orifice Restrictor
- Residential Streets: 3-inch Vortex Restrictor
- Alleys: 3-inch Orifice Restrictor in the last catch basin

When using an orifice restrictor, insert it into the half-trap. Upon tightening of the center nut on the face of the restrictor, the rubber O-rings will expand inside the half trap providing a water-tight seal. Pull on the restrictor to verify a tight fit is made.

When applying a vortex restrictor, insert it with the opening down. Upon tightening of the 2 bolts on the face of the restrictor, the rubber O-rings will provide a water-tight seal. Pull on the restrictor to verify a tight fit is made.

Basis of Payment. This work will be paid for at the contract unit price per each for CATCH BASINS, of the type, diameter specified, type of frame and grate or type of frame and lid specified (CITY OF CHICAGO).

DRAINAGE STRUCTURES TO BE RECONSTRUCTED (SPECIAL)

Description. Work under this item shall be performed according to Section 602 of the Standard Specifications, except as herein modified.

This work shall consist of removing and disposing of the upper portions of existing manholes and catch basins including but not limited to frames and grates, frames and lids, cones, and flat slab tops and then placing a solid precast reinforced concrete flat slab top over the drainage structure. This precast reinforced concrete flat slab top shall not have a 24" manway.

Construction Requirements. The existing manhole or catch basin shall be removed to an elevation at least 6 inches below the bottom of the existing pavement or as directed by the Engineer. The manhole or catch basin shall be securely sealed with a solid precast reinforced concrete flat slab top as directed by the Engineer. The solid precast reinforced concrete flat slab top shall be constructed as per IDOT Standard 602601-02 except that a 24" manway shall not be provided. The solid precast reinforced concrete flat slab top shall not be placed below the top of the highest pipe. Backfilling of the drainage structures to the grades necessary for the placement of the temporary pavement shall be included in the price of this item. All backfilling shall be performed according to Section 602 of the Standard Specifications and to the satisfaction of the Engineer.

Submittals. The Contractor shall submit shop drawings for the solid precast reinforced concrete flat slab top to the Engineer for review and approval.

Method of Measurement. This work will be measured for payment as each.

Basis of Payment. This work will be paid for at the contract unit price per each for CATCH BASINS TO BE RECONSTRUCTED (SPECIAL) which price shall include all labor, excavation, backfilling, materials, and equipment necessary to remove and dispose of the upper portions of existing structures including but not limited to frames and grates, frames and lids, cones, and flat slab tops and placing a solid precast reinforced concrete flat slab top over the drainage structure and backfilling of the structure.

FRAMES AND LIDS TO BE ADJUSTED (SPECIAL)

Description: This work shall be performed according to Section 602 of the Standard Specifications, except as herein modified.

This work shall consist of the adjustment of existing City electric manholes, valve vaults, water meter vaults or other structures. This work shall include the first two feet of masonry required to be added, removed or rebuilt to bring the specified casting to the finished grade of the proposed improvement.

Materials: The Cement Factor shall be a minimum of 7.35 cwt. The mix shall be designed according to Section 3.0 of the IDOT QC/QA PCC Level III Technician Manual. High early strength concrete must achieve a minimum compressive strength of 3,500 psi within 3 days of placement.

The use of HMA for pavement patching is not allowed.

The use of HDPE plastic adjusting rings (602.02(l)) is not allowed.

The use of Recycled Rubber Adjusting rings (602.02(m)) is not allowed.

General Requirements: Under no circumstance will an adjustment not be completed in the same day as it is started.

Under no circumstance will any debris be left in the street overnight.

The Contractor must stage adjustment work so that the traffic flows in a safe manner.

Prior to starting construction, an inspection of all the existing structures, shall be made by the Engineer and the Contractor to determine the amount of existing debris in these structures.

All existing structures which are to be adjusted or reconstructed shall be cleaned in Accordance with Article 602.15.

Method of Measurement. FRAMES AND LIDS TO BE ADJUSTED (SPECIAL) shall be measured for payment for each frame and lid adjusted.

Basis of Payment. This work will be paid for at the contract unit price per each for FRAMES AND LIDS TO BE ADJUSTED (SPECIAL).

STEEL POSTS, SPECIAL

Description: This work consists of furnishing sign poles of various lengths and installation either by dig method or drill method as shown on the Contract Drawings. The poles installed using dig method shall be 10 feet and 8 inches in length and the poles installed using drill method shall be 9 feet and 8 inches in length. The cost of wedges, sleeves, pole bases and all other required hardware to install poles is included in the cost of these items.

Materials: The material for the poles furnished must be hollow steel tubes, 2 - 3/8 inches outside diameter, conforming to ASTM A500 Grade B and coated for resistance to corrosion and outdoor weathering. Nominal wall thickness of the pole must be 0.08". The sign pole must be formed to the size and type specified in the Contract Drawings. Holes must be drilled prior to coating to prevent indentations and dimples in the poles.

Finish: The poles must be galvanized, straight and have a smooth, black, uniform powder coating finish as specified below. The interior of the sign poles must be coated with a minimum of an 81% zinc rich primer. The exterior of the poles must be galvanized with material conforming to AASHTO M 120 with a minimum weight of 1.00 ounce per square foot. The weight of the exterior galvanizing may be reduced to 0.65 ounces per square foot of High Grade material conforming to AASHTO M120 if applied with a chromate conversion coating and a clear high performance organic polymer coating. Powder coating of the poles and extensions must meet the following requirements:

Color: Vulcan Black Polyester
Product No.: PFB-401-S6
Cure: 400F-18 minutes PMT
Resin type: Polyester
Gloss: Medium

or approved equal.

Pretreatment Process:

Cleaning: All parts must be cleaned utilizing spray washers and an alkaline cleaner to remove any remaining grease, dirt, or other contaminants.

Rinsing: All parts must be spray rinsed in a continuously overflowing rinse stage to remove any remaining cleaning solution.

Phosphating: All parts must be spray phosphated with a heated phosphate solution to provide a transition coating between metal and powder.

Rinse: All parts must be spray rinsed in a continuously overflowing rinse stage to remove any remaining phosphate / sealant solution.

Powder Coating Process:

Drying: All parts must be preheated to totally eliminate moisture and Prevent offgassing of casting.

Powder Coating: A premium TGIC polyester powder must be Electrostatically applied to provide a uniform coating to a thickness of 1-3 mils (1 mil minimum). To achieve proper mil thickness, the powder must be applied with one application. The manufacturer must be responsible for ensuring proper adhesion to the metal surface.

Curing: All parts must be heated to the exact time and temperature requirements, recommended by the powder coat material manufacturer, in precisely controlled gas ovens.

Sleeve and Locking Wedge:

Pole sleeve (pipe socket): Material must be hollow steel tubes conforming to ASTM A500 Grade B or ASTM A501, and galvanized according to AASHTO M111, nominal wall thickness of 0.109", 2-5/8 inch inside diameter that allows for a minimum of 13-1/4 " of sign pole to nest inside the sleeve. The overall length of pole sleeve must be 27". A drawing detail as shown in the Appendix I shall govern.

Locking wedge: Material shall be 11 gauge steel tube conforming to ASTM A500 Grade B or ASTM A501 and galvanized according to AASHTO M111. The locking wedge shall be contoured to fit between the steel pole and the 27-inch sleeve. A drawing detail as shown in Appendix I shall govern.

Sign Pole Base:

The sign pole base furnished under this contract includes a carriage bolt, tamper-resistant nuts, and anchor bolts with nuts. The finished casting must be free from burrs, cracks, voids, or other defects.

Support base: Twelve-inch diameter, aluminum-zinc alloy casting per ASTM A197. The casting must have the words "City of Chicago" cast in relief as shown in the drawings provided in the Appendix I of these specifications.

Bolt washers and nut: Stainless steel as specified in Article 1006.31a of the Standard Specifications. Include a 1/2" x 4-1/2" carriage bolt with two 1" flat washers and a 1/2"-13 full height hex nylon locknut.

Anchor Bolt: Galvanized steel expansion anchors conforming to Article 1006.09 of the Standard Specifications. Red Head #1236 (1/2" x 3-3/4"). Furnish three (3) per each sign base provided.

Finish: Powder coat to minimum 1 mil thickness with satin black polyester finish.

Submittals/Material Acceptance: Shop Drawings: Fabrication shop drawings showing the full size layout, color, and proposed materials for poles, bases, and hardware must be submitted for approval prior to start of fabrication.

Poles : Mill certification, samples of each size of finished pole and extension.

Locking wedge and sleeve: Samples of each item.

Cast aluminum base: Mill Certifications.

Powder coating: Test Data; Sample; Manufacturer's Certification that material complies with the required specifications.

Galvanizing: Manufacturer's Certification for compliance with these specifications.

Stainless steel bolts and nuts, anchor bolts: sample, product data sheet.

Installation:

All installation shall be performed in accordance with Article 720.04 of the Standard Specifications.

Dig Method: This method shall be used to install all poles in turf. To install a sign pole by dig method, the Contractor will first drive a base sleeve to a level with the top of the sleeve near flush to the ground. The sign pole will then be inserted into the sleeve and raised to a level with the bottom of the pole 10 to 12 inches below the ground. The sign pole will then be locked in place by driving a locking wedge between the sign pole and the base sleeve. Note: Pipe sleeve and wedge shall not be bolted together. The holes at the top of the sign pole will be properly aligned such that the sign to be installed will properly face the flow of traffic.

Drill Method: This method shall be used to install all poles in pavement, sidewalk, and bridge decks. The base will be secured to the concrete surface by steel expansion anchors and must be leveled by using stainless steel washers as shims at the anchor bolt locations and under the base castings. The sign pole will be installed into the cast iron base and locked in place with a carriage bolt with two flat washers and a nylon lock nut as shown in the Appendix I. The holes at the top of the sign pole must be aligned such that the sign to be installed will properly face the flow of traffic.

Sign poles will be installed 18" from back of curb unless otherwise specified. Poles for transportation stops, e.g. bus, taxi, tour bus, or tour boat stops, must be installed 24" from the back of the curb unless otherwise noted.

Warranty:

Manufacturer's warranties shall be 5 (five) years. The final punch list completion and acceptance date constitutes the start of the warranty period.

Method of Measurement. STEEL POSTS, SPECIAL shall be measured for payment for each pole furnished and installed.

Basis of Payment. This work will be paid for at the contract unit price per each for STEEL POSTS, SPECIAL which shall include the poles, all sleeves, locking wedges, bases and all other required hardware to complete the installation of poles.

CONCRETE BARRIER WALL (SPECIAL)

Description. This work shall consist of constructing a concrete barrier wall with reinforcement bars on a concrete barrier base as detailed in the plans.

Construction Requirements. This work shall be done in accordance with the applicable portions of Section 637 of the Standard Specifications. The concrete barrier wall shall be constructed on a concrete barrier base as detailed in the plans. The concrete barrier wall shall be constructed separately and not poured monolithically with the concrete barrier base.

Method of Measurement. CONCRETE BARRIER WALL (SPECIAL) shall be measured for payment in feet along the centerline of the barrier. The concrete barrier base will be paid for separately according to CONCRETE BARRIER BASE (SPECIAL).

Basis of Payment. This work will be paid for at the contract unit price per foot for CONCRETE BARRIER WALL (SPECIAL), which price shall include all equipment, labor, and materials necessary to construct the concrete barrier wall including all reinforcement bars in the concrete barrier wall.

CONCRETE BARRIER TRANSITION (SPECIAL)

Description. This work shall consist of constructing a concrete barrier transition between barriers of different design. The concrete barrier transition shall include reinforcement bars and be constructed on a concrete barrier base as detailed in the plans.

Construction Requirements. This work shall be done in accordance with the applicable portions of Section 637 of the Standard Specifications. The concrete barrier transition shall be constructed on a concrete barrier base as detailed in the plans. The concrete barrier transition shall be constructed separately and not poured monolithically with the concrete barrier base.

Method of Measurement. CONCRETE BARRIER TRANSITION (SPECIAL) shall be measured for payment in feet along the centerline of the transition. The concrete barrier base will be paid for separately according to CONCRETE BARRIER BASE (SPECIAL).

Basis of Payment. This work will be paid for at the contract unit price per foot for CONCRETE BARRIER TRANSITION (SPECIAL), which price shall include all equipment, labor, and materials necessary to construct the concrete barrier transition including all reinforcement bars in the concrete barrier transition.

TEMPORARY CHAIN LINK FENCE

Description. This work shall consist of furnishing, installing, maintaining, relocating and removing temporary chain link fence and gates. Temporary chain link fence shall be used to provide access control around the Peoria Street Bridge during construction. The fence and gates are to be installed at locations as specified on the plans or as directed by the Engineer. Work under this item shall be performed according to Section 664 of the IDOT Standard Specifications for Road and Bridge Construction, except as herein modified.

General Requirements. The Temporary Chain Link Fence shall be at least 8 feet in height. The Temporary Chain Link Fence shall be self-standing without the need to disturb the surface ground by excavation when adjacent to areas where no proposed work is to take place. The stand shall be made of galvanized steel pipe or similar materials. The Temporary Chain Link Fence may be anchored into existing pavement or sidewalk where the sidewalk or pavement is shown to be removed. Each fence panel shall be made from welded wire panels or out of chain link fence materials. All the necessary bases, panel clamps and bolts shall be included and installed in accordance to the manufacturer specifications and to the satisfaction of the Engineer.

The Temporary Chain Link Fence shall utilize opaque fabric meshing affixed to the chain link fence face. The fabric meshing shall allow passage of air but shall contain dust and dirt. The mesh fabric shall be the full height of the fence and cover the entire length of the fence including any gated opening. The fabric meshing and fence shall not contain any advertisement. The color of the fabric shall be approved by the Engineer.

Gates shall be installed where stabilized construction entrances are proposed or at locations approved by the Engineer to provide Contractor access to the work area. The gates shall be locked at the end of each work day.

Method of Measurement. Temporary Chain Link Fence shall be measured for payment in feet, along the top of the fence from center to center of end posts, including the length occupied by gates.

Basis of Payment. Temporary Chain Link Fence will be paid for at the contract unit price per foot for TEMPORARY CHAIN LINK FENCE for which said price shall include all labor, materials, equipment, furnishing, installing, maintaining and incidentals necessary for placement, relocation and removal and disposal of the temporary chain link fence and gates.

ENGINEER'S FIELD OFFICE TYPE A (SPECIAL)

This item shall consist of furnishing all utilities and maintaining in good condition the existing office space and all appurtenances included in it, including but not limited to all communication devices, internet service, water coolers, copy machines, printers, refrigerators, air conditioning and heating systems, water services, furniture, buildings and all appurtenances thereof located at 900 South Des Plaines Street, Chicago, for the exclusive use of the Engineer or Authorized Representative. The Office shall meet the requirements of Article 670.02 of the Standard Specifications.

The office space shall be maintained and kept in a clean condition at all times. The Contractor shall provide janitorial and/or cleaning service for a minimum of twice a week. Windows and window blinds shall be cleaned as directed by the Engineer. Maintenance shall include, but not limited to supply of paper towels, soap, toilet paper, and other necessary supplies. No additional compensation will be allowed for providing this service.

The existing interior walls may require one (1) coat of paint, as directed by the Engineer, at no additional cost.

The Contractor shall be responsible for security of the field office building and is liable for damages incurred as a result of vandalism, theft, and other criminal activities. Broken doors, windows or other appurtenances shall be replaced at no additional cost.

Four (4) on-site sanitary facilities shall be maintained.

The Contractor will be responsible for systems maintenance repairs which shall include the heating, cooling, sanitary and water distribution systems and light bulb replacements.

The (10) fire extinguishers meeting City of Chicago requirements shall be maintained.

The Contractor will be responsible for snow removal from parking areas and sidewalks surrounding the building & repair parking area damages as directed by the Engineer, at no additional cost.

The Contractor shall pay the cost of any building or equipment inspections by the City of Chicago. The Contractor shall also pay all costs to comply with the maintenance type inspection findings.

One (1) office copier black and white/color that has full network connectivity for all multifunction such as print, copy, scan and fax. The printer will have the capability of printing and scanning high quality documents as well as 11X17 size papers. The copier shall be complete with automatic document feeder and sorter. The unit shall have the ability to perform scanning over the network with the ability to generate files in JPEG, TIFF and PDF formats. Also included is the maintenance (servicing and repair as required) and operating supplies (paper supply of required sizes, ink and toner).

Basis of Payment: The office space maintenance and related support services will be paid for on a monthly basis until the space is released by the Engineer. The Contractor will be paid at the contract bid price each month, provided the space is maintained, equipped, and utilities furnished at the direction of the Engineer. Payment will not be made when the contract is suspended in accordance with Article 108.07 of the Standard Specifications for failure of the Contractor to comply with the provisions of the contract. The space, fully equipped and maintained as specified herein, will be paid for at the contract unit price per calendar month or fraction thereof for ENGINEER'S FIELD OFFICE TYPE A (SPECIAL). This price shall include all utility costs and shall reflect the salvage value, if any, of the equipment and furniture which becomes the property of the Contractor after release by the Engineer, except that the Department will pay that portion of each monthly long distance telephone bill in excess of \$50.

The Contractor shall be responsible for the repair and maintenance of the field office and all its related appurtenances. No extra payment will be made for systems maintenance, repairs or for damages incurred as a result of vandalism, theft or other criminal activities.

REMOVE OVERHEAD SIGN STRUCTURE - WALKWAY

Description. This work shall consist of removing walkways, walkway supports, and hardware connected to overhead sign structures.

Construction Details. The Contractor shall remove the existing walkway completely from the sign truss or bridge mounted sign including its supports. The Contractor shall notify the Engineer 72 hours in advance of any walkway removal activities planned to take place over the Expressway. All items shall be transported and disposed of offsite, unless otherwise directed by the Engineer.

Method of Measurement. The length of walkway removed from a structural sign truss or bridge mounted sign, including all brackets, hardware, and any additional materials attaching walkway to the structure, not including brackets supporting existing sign, will be measured for payment, in units per foot.

Basis of Payment. This work will be paid for at the contract unit price per foot for REMOVE OVERHEAD SIGN STRUCTURE – WALKWAY which price shall include all equipment, materials and labor required to remove and dispose of designated walkway, supports, and corresponding hardware.

RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL

Description. This work shall consist of completely removing and disposing of the existing reflector.

The Contractor shall take care not to damage the raised reflective pavement marking unit. All damaged units shall be removed and replaced at the Contractor's expense.

Method of Measurement. RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL shall be measured for payment on a per each unit removed basis.

Basis of Payment. RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL shall be paid for per each unit removed, which price shall include all equipment, labor, and materials necessary to remove the reflector.

LIGHT POLE FOUNDATION, SPECIAL

Description. This foundation will be for structural support of a residential street light pole. The foundation will be poured in place or precast, must be 20" in diameter, with a 10" bolt circle, 1" diameter anchor rods, and must be 5 feet in depth as specified herein, as shown on the plans, and as directed by the Engineer.

Material. Concrete must be Portland Cement Concrete meeting the requirements of Article 1020 of the Standard Specifications for SI Class concrete. Anchor rods must meet the requirements of Material Specification 1467 and the ground rod must meet the requirements of Material Specification 1465. Conduit elbows will be PVC conduit meeting the requirements of Material Specification 1533.

Construction. Foundations must conform to Drawing Number 565. The top surface of the foundation in parkway must be at an elevation of two inches (2) above grade, or as directed by the Engineer. Care should be taken to install a level foundation and to ensure adequate anchor rod projections for double nut installation. The foundation top must be chamfered 3/4 of an inch. The foundations must be centered back from the face of the curb in accordance with dimensions shown on the construction plans. When the foundation is in a solid sidewalk area, the foundation must be installed level, with the height of the foundation as close to the height of the sidewalk as possible, or as directed by the Engineer. A proper expansion joint must be installed between the sidewalk and the foundation.

Foundation raceways must consist of large radius conduit elbow(s) in quantity, size and type specified on Drawing 565 or as shown on the construction plans. Elbows, in excess of the number shown on Drawing 565, will be paid for under a separate pay item. The Contractor must furnish anchor rods, hardware, conduit elbow(s) and all other material shown on applicable foundation construction drawings. Depth of foundation will be as noted on Drawing 565.

For poured in place foundations, a hole must be augered for placement of a form for the concrete. The anchor rods must be set by means of a metal template which must be submitted for approval before any foundation work is begun. The template must hold the rods vertical, and in proper position.

Foundations that are precast must conform to Standard Drawing 565. The conduit elbows must be installed as specified, at angles to each other of from 0 to 180 degrees. A one inch conduit sleeve must be installed in the precast foundation to accommodate the ground rod. A 36" hole must be augered for the precast foundation to a depth of 5'6". Screenings must be used as backfill and must be tamped at every 6" level. The last 6 inches of fill should be topsoil. Two inches of the foundation should be exposed above grade.

Method of Measurement. The measurement will be measured per lineal foot of concrete foundation installed.

Basis of Payment. Payment will be made for foundations installed in place including two (2) elbows in accordance with construction plans and these specifications. All necessary excavation and restoration of soil, pavement, sidewalk and expansion joint, and fill to its original condition will be included in the unit price. This work will be paid for at the contract unit price per lineal foot, for LIGHT POLE FOUNDATION, SPECIAL.

CONCRETE FOUNDATION (SPECIAL)

Description. This item consists of providing a concrete foundation that will be the bollard base for a standard UIC Emergency Telephone Unit (ETU). The foundation will be poured in place or precast, must be 24" in diameter, with an 8" bolt circle, 3/4" diameter anchor rods, and must be 3 feet in depth as specified herein, as shown on the plans, and as directed by the Engineer.

Two composite (Quazite) junction boxes with covers shall be included with each ETU foundation as shown on the plans.

The UIC Emergency Telephone Unit (ETU) will be provided and installed on the concrete foundation by others.

All work shall be coordinated with the University of Illinois at Chicago's (UIC) TELECOM/ACCC Engineering Department,

Material. Concrete must be Portland Cement Concrete meeting the requirements of Article 1020 of the Standard Specifications for SI Class concrete. Anchor rods must be 24" long stainless steel J-Bolts. The ground rod must meet the requirements of Material Specification 1465 and shall be included as part of this pay item. Conduit elbows will be PVC conduit meeting the requirements of Material Specification 1533.

Construction and Installation. Construction and installation of the foundation of the ETU bollard base shall be as shown on the plans.

Method of Measurement. The foundation shall be measured per lineal foot of concrete foundation installed.

Basis of Payment. This item shall be paid for at the contract unit per lineal foot for CONCRETE FOUNDATION (SPECIAL), which shall be payment in full for the installation.

BOLLARDS

Description. This work shall consist of furnishing and installing a removable manufactured metal pipe bollard which meets the specifications described herein and in accordance with the manufacturer's specifications and instructions

The Contractor, and/or manufacturer selected by the Contractor and approved by the Engineer, shall furnish all labor, materials, equipment and incidentals required to install the bollard and appurtenances in accordance with the Drawings and its respective manufacturer's specifications. Complete installation shall include but not be limited to the following: excavation and backfill of the installation location, bollard, foundation, removal and locking hardware, and traffic warning devices.

Submittals. The Contractor shall submit manufacturer's specifications, anchor details and installation instruction for products to be used in the fabrication of miscellaneous metal work, including painting products and grout for approval by the Engineer prior to fabrication.

Quality Assurance. The Contractor shall take field measurements prior to preparation of shop drawings and fabrication, where possible. The measurements shall allow for trimming and fitting before fabrication.

The bollard shall be preassembled in the shop to greatest extent possible to minimize field splicing and assembly. The units shall be disassembled only as necessary for shipping and handling limitations.

Materials. The bollard shall be a steel cylinder with a flat or rounded top designed to shield an area from unwanted encroachment by passenger vehicles and light trucks. No arms or protrusions shall be permitted on the bollard. The bollard shall be stainless steel with a single reflective yellow stripe located near the top of the bollard.

The bollard shall be removable by ordinary efforts of a single person. To prevent theft and vandalism, the bollard shall be locked to its foundation with a padlock, to be supplied by the manufacturer or approved by the Engineer. The keys to the padlock shall be distributed as directed by the Engineer. All bollards installed shall be keyed alike.

The bollard shall be not less than 4" and not more than 6" in nominal outside diameter. The top of the bollard shall not be less than 36" above the finished grade, and not more than 42". It shall be embedded at a minimum of 12" below the finished grade. If the manufacturer's specifications differ from this depth, it shall be approved by the Engineer prior to installation.

The bollard foundation must be equipped with a flap or other device designed to cover the foundation hole left upon removal of the bollard to minimize tripping hazards.

The following manufacturers are capable of supplying removable bollards that meet the requirements of these specifications.

1. Calpipe Security Bollards.
12021 Woodruff Ave
Downey, CA 90241
Product: Model IBP0480
2. TrafficGuard.
P.O. Box 201
Geneva, IL 60134-9946
Product: RPL 4

Substitutions after the award shall be approved by the Engineer.

Method of Measurement. This work shall be measured for payment per each BOLLARD installed.

Basis of Payment. This work will be paid for at the contract unit price per each BOLLARD which shall include all labor, equipment, foundation locks, locking mechanisms, pipe bollard, and accessories to install the bollard.

APPROACH SLAB REMOVAL

Description. This work shall consist of the complete removal of the existing approach slabs including bituminous overlays, reinforcing bars, and sleeper slabs, at locations designated in the plans and in accordance with the applicable portions of Sections 440 and 501 of the Standard Specifications.

This work shall also include the removal of existing timber piles and pile caps to at least 300mm (1 ft) below the proposed elevation of subgrade or ground surface within the approach slab removal area and within the limits of the right of way when encountered. This work shall also include the removal of any mud jack cylinders encountered within the existing approach slabs.

The Contractor shall remove the existing approach slabs in a manner so as not to damage the adjacent structures that are to remain.

Method of Measurement. APPROACH SLAB REMOVAL shall be measured in place in square yards.

Basis of Payment. This work will be paid for at the contract unit price per square yard for APPROACH SLAB REMOVAL, which price shall include all labor and equipment necessary to remove and dispose of the entire approach slab pavement.

WELDED WIRE FABRIC 6X6

Description. This work shall consist of furnishing and placing welded wire fabric of the spacing and size shown on the plans. Welded wire fabric shall be epoxy coated where specified on the plans.

Materials. Materials shall be according to Article 1006.10 of the Standard Specifications. Epoxy coated welded wire fabric shall be according to Article 1006.10(b) and shall be epoxy coated according to AASHTO M 284 and Article 1006.10(a)(2)(a), 1006.10(a)(2)(b) and 1006.10(a)(2)(c) of the Standard Specifications.

Method of Measurement. This work will be measured for payment in place and the area computed in square yards.

Basis of Payment. This work will be paid for at the contract unit price per square yard for WELDED WIRE FABRIC 6X6.

STABILIZED CONSTRUCTION ENTRANCE

Description. This work consists of constructing a stabilized pad of coarse aggregate underlain with geotechnical fabric at locations shown on the plans. Cellular confinement grids shall be used to contain the aggregate at the pad boundaries. Also included is the removal and satisfactory disposal of the stabilized construction entrance when no longer required.

All work must conform to the applicable portions of Section 202, 210, 1004 and 1080 of the Standard Specifications, the details shown on the plans or as directed by the Engineer.

Materials. Aggregate shall consist of coarse aggregate gradations CA-1, CA-2, CA-3, or CA-4 meeting the requirements of Article 1004.04 of the Standard Specifications. Aggregate thickness shall be as detailed on the plans. Geotechnical fabric shall meet the requirements of Article 1080.02 of the Standard Specifications.

General Requirements. Excess of unsuitable excavated materials shall be disposed of in accordance with Article 202.03 of the Standard Specifications. The coarse aggregate surface course shall be compacted to the satisfaction of the Engineer. The stabilized pad shall be a minimum of 6 inches thick. The area shall be restored as shown on the plans

Method of Measurement. This work will be measured for payment in place and the area computed in square yards.

Basis of Payment. This work will be paid for at the contract unit price per square yard for STABILIZED CONSTRUCTION ENTRANCE, which price shall be payment in full for geotechnical fabric, cellular confinement grids, furnishing, placing, compacting and disposing of coarse aggregate, and for all labor, tools and equipment necessary to construct the work as specified.

FENCE REMOVAL

Description. This work shall consist of removing and disposing the existing fence of all kinds as shown in the Plans or otherwise directed by the Engineer.

Construction Requirements. No removal work shall be completed without the approval of the Engineer. All associated hardware and appurtenances of the existing fence including but not limited to post foundations, fittings, gates, post, and accessories, shall be removed off-site and disposed of by the Contractor in a legal disposal site. All postholes shall be backfilled and compacted to the satisfaction of the Engineer. Any part of the fence that is damaged that is not called out for to be removed shall be replaced at the Contractor's expense.

Method of Measurement. Fence removal shall be measured for payment in feet of FENCE REMOVAL and measured along the top of the fence from center to center of end post, including the length occupied by gates.

Basis of Payment. This work will be paid for at the contract unit price per foot for FENCE REMOVAL, which price shall include all equipment, labor, and materials necessary to remove and dispose of the fence, associated hardware, and appurtenances.

MAINTENANCE OF LIGHTING SYSTEMS

Effective: January 1, 2012

Replace Article 801.11 and 801.12 of the Standard Specifications with the following:

Effective the date the Contractor's activities (electrical or otherwise) at the job site begin, the Contractor shall be responsible for the proper operation and maintenance of all existing and proposed lighting systems which are part of, or which may be affected by the work until final acceptance or as otherwise determined by the Engineer.

The Contractor shall be responsible for the proper operation and maintenance of the following existing and proposed lighting systems under this contract:

- Existing IDOT Lighting Controller 'G'; Circuits A, B, G and H.

Before performing any excavation, removal, or installation work (electrical or otherwise) at the site, the Contractor shall initiate a request for a maintenance transfer and preconstruction inspection, as specified elsewhere herein, to be held in the presence of the Engineer and a representative of the party or parties responsible for maintenance of any lighting systems which may be affected by the work. The request for the maintenance preconstruction inspection shall be made no less than seven (7) calendar days prior to the desired inspection date.

Existing lighting systems, when depicted on the plans, are intended only to indicate the general equipment installation of the systems involved and shall not be construed as an exact representation of the field conditions. It remains the Contractor's responsibility to visit the site to confirm and ascertain the exact condition of the electrical equipment and systems to be maintained.

Maintenance of Existing Lighting Systems

Existing lighting systems. Existing lighting systems shall be defined as any lighting system or part of a lighting system in service at the time of contract Letting. The contract drawings indicate the general extent of any existing lighting, but whether indicated or not, it remains the Contractor's responsibility to ascertain the extent of effort required for compliance with these specifications and failure to do so will not be justification for extra payment or reduced responsibilities.

Extent of Maintenance.

Partial Maintenance. Unless otherwise indicated, if the number of circuits affected by the contract is equal to or less than 40% of the total number of circuits in a given controller and the controller is not part of the contract work, the Contractor needs only to maintain the affected circuits. The affected circuits shall be isolated by means of in-line waterproof fuse holders as specified elsewhere and as approved by the Engineer.

Full Maintenance. If the number of circuits affected by the contract is greater than 40% of the total number of circuits in a given controller, or if the controller is modified in any way under the contract work, the Contractor shall maintain the entire controller and all associated circuits.

Maintenance of Proposed Lighting Systems

Proposed Lighting Systems. Proposed lighting systems shall be defined as any lighting system or part of a lighting system, temporary or permanent, which is to be constructed under this contract.

The Contractor shall be fully responsible for maintenance of all items installed under this contract. Maintenance shall include, but not be limited to, any equipment failures or malfunctions as well as equipment damage either by the motoring public, Contractor operations, vandalism, or other means. The potential cost of replacing or repairing any malfunctioning, damaged, or vandalized equipment shall be included in the bid price of this item and will not be paid for separately.

Lighting System Maintenance Operations

The Contractor's responsibility shall include all applicable responsibilities of the Electrical Maintenance Contract, State of Illinois, Department of Transportation, Division of Highways, District One. These responsibilities shall include the maintenance of lighting units (including sign lighting), cable runs and lighting controls. In the case of a pole knockdown or sign light damage, the Contractor shall promptly clear the lighting unit and circuit discontinuity and restore the system to service. The equipment shall then be re-set by the contractor within the time limits specified herein.

If the equipment damaged by normal vehicular traffic, not contractor operations, is beyond repair and cannot be re-set, the contractor shall replace the equipment in kind with payment made for such equipment under Article 109.04. If the equipment damaged by any construction operations, not normal vehicular traffic, is beyond repair and cannot be re-set, the contractor shall replace the equipment in kind and the cost of the equipment shall be included in the cost of this pay item and shall not be paid for separately.

Responsibilities shall also include weekly night-time patrol of the lighting system, with patrol reports filed immediately with the Engineer and with deficiencies corrected within 24 hours of the patrol. Patrol reports shall be presented on standard forms as designated by the Engineer. Uncorrected deficiencies may be designated by the Engineer as necessitating emergency repairs as described elsewhere herein.

The following chart lists the maximum response, service restoration, and permanent repair time the Contractor will be allowed to perform corrective action on specific lighting system equipment.

INCIDENT OR PROBLEM	SERVICE RESPONSE TIME	SERVICE RESTORATION TIME	PERMANENT REPAIR TIME
Control cabinet out	1 hour	4 hours	7 Calendar days
Hanging mast arm	1 hour to clear	na	7 Calendar days
Radio problem	1 hour	4 hours	7 Calendar days
Motorist caused damage or leaning light pole 10 degrees or more	1 hour to clear	4 hours	7 Calendar days
Circuit out – Needs to reset breaker	1 hour	4 hours	na
Circuit out – Cable trouble	1 hour	24 hours	21 Calendar days
Outage of 3 or more successive lights	1 hour	4 hours	na
Outage of 75% of lights on one tower	1 hour	4 hours	na
Outage of light nearest RR crossing approach, Islands and gores	1 hour	4 hours	na
Outage (single or multiple) found on night outage survey or reported to EMC	na	na	7 Calendar days
Navigation light outage	na	na	24 hours

- **Service Response Time** -- amount of time from the initial notification to the Contractor until a patrolman physically arrives at the location.
- **Service Restoration Time** – amount of time from the initial notification to the Contractor until the time the system is fully operational again (In cases of motorist caused damage the undamaged portions of the system are operational.)
- **Permanent Repair Time** – amount of time from initial notification to the Contractor until the time permanent repairs are made if the Contractor was required to make temporary repairs to meet the service restoration requirement.

Failure to provide this service will result in liquidated damages of \$500 per day per occurrence. In addition, the Department reserves the right to assign any work not completed within this timeframe to the Electrical Maintenance Contractor. All costs associated to repair this uncompleted work shall be the responsibility of the Contractor. Failure to pay these costs to the Electrical Maintenance Contractor within one month after the incident will result in additional liquidated damages of \$500 per month per occurrence. Unpaid bills will be deducted from any monies owed to the Contractor. Repeated failures and/or a gross failure of maintenance shall result in the State's Electrical Maintenance Contractor being directed to correct all deficiencies and the resulting costs deducted from any monies owed the contractor.

Damage caused by the Contractor's operations shall be repaired at no additional cost to the Contract.

Operation of Lighting

The lighting shall be operational every night, dusk to dawn. Duplicate lighting systems (such as temporary lighting and proposed new lighting) shall not be operated simultaneously. Lighting systems shall not be kept in operation during long daytime periods.

Method of Measurement. The contractor shall demonstrate to the satisfaction of the Engineer that the lighting system is fully operational prior to submitting a pay request. Failure to do so will be grounds for denying the pay request. Months in which the lighting systems are not maintained and not operational will not be paid for. Payment shall not be made retroactively for months in which lighting systems were not operational.

Basis of Payment. Maintenance of lighting systems shall be paid for at the contract unit price per calendar month for MAINTENANCE OF LIGHTING SYSTEM, which shall include all work as described herein.

TEMPORARY PAVEMENT

Description. This work shall consist of constructing a temporary pavement at the locations shown on the plans or as directed by the Engineer.

The Contractor shall use either Portland cement concrete (PCC) according to Sections 353 and 354 of the Standard Specifications or hot-mix asphalt (HMA) according to Sections 355, 356, 406 of the Standard Specifications, and other applicable PCC and HMA special provisions as contained herein. The HMA mixtures to be used shall be specified in the plans. The thickness of the Temporary Pavement shall be as described in the plans. The Contractor shall have the option of constructing either material type if both Portland cement concrete and HMA are shown in the plans. The Contractor shall furnish and construct Subbase Granular Material, Type B 4" under the temporary pavement in accordance with the Standard Specifications.

Articles 355.08 and 406.11 of the Standard Specifications shall not apply.

The Temporary Pavement shall remain in place unless otherwise noted on the plans, and if so, the removal shall conform to Section 440 of the Standard Specification.

Method of Measurement. TEMPORARY PAVEMENT and SUBBASE GRANULAR MATERIAL, TYPE B 4" will be measured in place and the area computed in square yards.

Basis of Payment. This work will be paid for at the contract unit price per square yard for TEMPORARY PAVEMENT and SUBBASE GRANULAR MATERIAL, TYPE B 4".

Removal of temporary pavement will be paid for at the contract unit price per square yard for PAVEMENT REMOVAL.

TEMPORARY SOIL RETENTION SYSTEM

Description. This work shall consist of designing, furnishing, installing, adjusting for stage construction when required and subsequent removal of the temporary soil retention system according to the dimensions and details shown on the Plans and in the approved design submittal, subject to the construction restrictions listed herein and on the drawings.

General. The temporary soil retention system shall be designed by the Contractor to retain, at a minimum, the exposed surface area specified in the Plans or as directed by the Engineer, including all loads as dictated by the site conditions. The design calculations and details for the temporary soil retention system proposed by the Contractor shall be submitted to the Engineer for approval. Design calculations and details for the temporary soil retention systems adjacent to the CTA tracks and/or CTA Right of Way proposed by Contractor must also be submitted to the CTA for approval. The calculations shall be prepared and sealed by an Illinois Licensed Structural Engineer. This approval will not relieve the Contractor of responsibility for the safety of the excavation. Approval shall be contingent upon acceptance by all involved utilities and/or railroads.

The design shall consider the restrictions on the installation of all components of the temporary soil retention system. These installation restrictions are listed in the next section of this special provision and in the "CONSTRUCTION VIBRATION MONITORING" special provision.

Construction. The Contractor shall verify locations of all underground utilities before installing any of the soil retention system components or commencing any excavation. Any disturbance or damage to existing structures, utilities or other property, caused by the Contractor's operation, shall be repaired by the Contractor in a manner satisfactory to the Engineer at no additional cost to the Department. Utility information shown on the drawings was collected from information available at the time of the design. There is no guarantee of complete accuracy with the utility locations.

The soil retention system must be installed without the use impact-type pile drivers. The location of the temporary soil retention system as shown on the drawings is in a highly sensitive populated area with the potential for damage to adjacent older structures. The proposed equipment and procedures used for installation of sheet piles or other underground support components must be submitted to the Engineer for approval prior to their use. It is anticipated that vibratory equipment may be utilized in performing the work, subject to requirements of other sections of this specification. Contractor shall also submit any documentation available regarding the operating noise levels and operating vibration characteristics of the equipment proposed, prior to approval of the Engineer.

The approval of the equipment and procedure by the Engineer does not guarantee the performance in the field of the equipment will be acceptable. If, in the judgment of the Engineer, the noise and/or vibration effects exceed those required by the local residents, then the Contractor must halt production and find a remedy suitable to the Engineer. Threshold values for vibration monitoring are included in the special provision "CONSTRUCTION VIBRATION MONITORING." The costs incurred finding suitable equipment and procedures shall be included in the cost of this item. No additional costs shall be paid for this effort.

The temporary soil retention system shall be installed according to the Contractor's approved design, or as directed by the Engineer, prior to commencing any related excavation. If unable to install the temporary soil retention system as specified in the approved design, the Contractor shall have the adequacy of the design re-evaluated. Any reevaluation shall be submitted to the Engineer for approval prior to commencing the excavation adjacent to the area in question. The Contractor shall not excavate below the maximum excavation line shown in the approved design without the prior permission of the Engineer. The temporary soil retention system shall remain in place until the Engineer determines it is no longer required. At the bottom of the temporary soil retention systems the Contractor shall be required to install a sump pit or a sedimentation basin as per the Illinois Urban Manual Details included in the plans. All water runoff or groundwater shall be directed to either the sump pit or sedimentation basin before it enters the drainage systems along I-290. If the Contractor uses a sump pit and is pumping the water out of the pit, a filter bag shall be required at the end of the pump discharge hose to ensure that sediment does not enter the storm sewer systems along I-290. Dewatering and draining areas along the temporary soil retention systems shall not be paid for separately but shall be included in the cost of TEMPORARY SOIL RETENTION SYSTEM.

The temporary soil retention system shall be removed and disposed of by the Contractor when directed by the Engineer. When allowed by the Engineer, the Contractor may elect to cut off a portion of the temporary soil retention system leaving the remainder in place. The remaining temporary soil retention system shall be removed to a depth which will not interfere with the new construction, and as a minimum, to a depth of 12 in. below the finished grade, or as directed by the Engineer. Removed system components shall become the property of the Contractor.

When an obstruction is encountered, the Contractor shall notify the Engineer and upon concurrence, the Contractor shall begin working to break up, push aside, or remove the obstruction. An obstruction shall be defined as any object (such as but not limited to, boulders, logs, old foundations etc.) where its presence was not obvious or specifically noted on the Plans prior to bidding, that cannot be driven or installed through or around, with normal driving or installation procedures, but requires additional excavation or other procedures to remove or miss the obstruction.

Portions of the existing roadway barriers must be removed in order to install the temporary soil retention system as shown on the drawings. This work shall be included in this pay item, and the barrier treated as an obstruction. The approval of the Engineer is required for the limits and method of removal, so that the barrier to remain can continue to function as intended.

Method of Measurement. The temporary soil retention system furnished and installed according to the Contractor's approved design or as directed by the Engineer will be measured for payment in square feet. The area measured shall be the vertical exposed surface area envelope of the excavation supported by temporary soil retention system. Portions of the temporary soil retention system left in place for reuse in later stages of construction shall only be measured for payment once.

Any temporary soil retention system installed beyond dimensions shown on the Plans or the approved Contractor's design without the written permission of the Engineer, shall not be measured for payment but shall be done at the Contractor's own expense.

Basis of Payment. This work will be paid for at the contract unit price per square foot for TEMPORARY SOIL RETENTION SYSTEM.

Payment for any excavation, related solely to the installation and removal of the temporary soil retention system and/or its components, shall not be paid for separately but shall be included in the unit bid price for TEMPORARY SOIL RETENTION SYSTEM. Other excavation, performed in conjunction with this work, will not be included in this item but shall be paid for as specified elsewhere in this contract.

Obstruction mitigation for other than the known tunnel obstruction shall be paid for according to Article 109.04 of the Standard Specifications.

SIPHON RECONSTRUCTION

Description. Work under this item shall consist of furnishing all labor, equipment and materials necessary for reconstruction of the sewer siphon lines as detailed in this specification. The work and removal and disposal of the existing sewer lines and water tunnels shall be performed according to Section 602 of the Standard Specifications, except as herein modified. The work to remove the existing siphon outlet junction chamber shall be performed and paid for according to the specification REMOVAL OF EXISTING STRUCTURES in the contract specifications. The work to remove the existing 54" concrete siphon pipe shall be performed and paid for according to the special provision COMBINED SEWER REMOVAL in the contract specifications.

Work shall consist of selective demolition and disposal of the upper portions of the existing siphon outlet junction chamber and the 54" concrete sewer line performed and paid for according to the special provisions REMOVAL OF EXISTING STRUCTURES and COMBINED SEWER REMOVAL, respectively. This work shall include construction of new 42", 36" and 14" siphon lines, connection of the three new siphon lines to the existing siphon lines, construction of a proposed siphon outlet junction box, the placement and removal of the temporary walls within the proposed siphon outlet junction box and connection of the outlet junction box to the existing 54" brick sewer line as detailed in the plans and specified herein.

The work shall also include the construction of temporary HDPE bypass siphon lines and managing the sewer bypass flows.

Also included in this work shall be the removal of portions of the existing 5 foot CTA water tunnel required to perform the SIPHON RECONSTRUCTION. The bulkheading of the CTA water tunnel shall be performed under a separate contract (Contract 60W26).

Construction Requirements. The proposed siphon outlet junction box shall be constructed around the existing 54" brick sewer line while maintaining flows in that line. The HDPE bypass siphon lines from the existing siphon outlet junction chamber to the proposed outlet junction box shall be installed and the flows diverted to the bypass lines. It is very important that the contractor performing the siphon reconstruction work closely and coordinate with the contractor constructing the soil retention systems due to the existing 54" siphon pipe being in conflict with the proposed soil retention system. As stated above the existing 54" siphon pipe will need to stay in service until the bypass siphon lines can be installed and all flows are diverted to the bypass siphon lines. The existing siphon outlet junction chamber shall be demolished to an elevation 575.00 including all concrete, piping and incidental items. Coordination during demolition shall be taken to avoid damaging the existing siphon lines, bypass lines or associated features during reconstruction. Any damage to the existing siphon or existing siphon structures that are to remain in place shall be repaired by the Contractor to the satisfaction of the Engineer and the Chicago Department of Water Management (CDWM) at the Contractor's expense. The WYE legs of the three (3) siphon lines shall be capped. The existing 54" concrete sewer line shall be demolished and removed and a temporary separation wall in the proposed siphon outlet junction box shall be constructed. The new 42" 36" and 14" siphon lines shall be constructed and connected to the proposed siphon outlet junction box. The new siphon lines shall be connected to the existing siphon lines. The bypass lines and temporary separation walls shall be removed and the openings in the proposed siphon outlet junction box shall be sealed.

Placement of encasement concrete fill and backfilling of the siphon lines and structures to the grades necessary for other portions of the work shall be included in the price of this item. All backfilling shall be performed according to Section 550 and Section 602 of the Standard Specifications and to the satisfaction of the Engineer.

All dimensions, elevations and pipe sizes for the existing siphon pipe system were taken from record drawings titled:

West Route Super Highway
Plans for Peoria Street Bridge
Section 2525.1-1B
F.A. Route No. 131 Project UI 261(29)
Approved July 1, 1949

Contractor shall verify all information, dimensions, elevations, sizes and geometries prior to construction or demolition and report any discrepancies to the engineer before proceeding.

The condition of the existing 54" brick sewer pipe shall be verified before demolition. It is assumed that the exterior of the sewer pipe is in good condition and the surface can be cleaned and prepared to accept the adhesive waterstop material to produce a sound water tight joint.

The surface under the siphon pipe encasement shall be examined for any soft or yielding areas. Any areas found to be unsuitable to support the siphon shall be excavated and recompact to provide suitable support for the siphon pipes.

The new ductile iron siphon pipe and fittings shall be securely supported to ensure no movement occurs prior to or during placement of the siphon pipe concrete encasement. The siphon pipe shall be supported so that a minimum of six (6) inches of concrete encasement can be placed around the pipe. Measures shall be taken to insure full consolidation of the concrete encasement material occurs around and under the siphon pipes.

The new ductile iron siphon pipe shall be securely supported at the connection to the existing siphon pipes to minimize any load on the existing pipe.

Demolition of the existing siphon outlet junction chamber shall be executed so that the existing siphon pipes are protected from damage. It is assumed from the date of construction that the pipes are Cast Iron and care shall be taken when removing concrete around the existing pipes that the pipes are not damaged.

It is assumed that the existing siphon pipe bells are in good condition and that the joints can be properly sealed using a Flexible Pipe Gasket Material. The connections will be encased in concrete after the pipe connections are completed

Submittals. The Contractor shall submit shop drawings and product information for:

1. Sequence of construction for the bypass lines, siphon lines and structures.
2. Cast in place concrete including concrete mix design, reinforcement steel shop drawings, forming plans and incidental items.
3. Ductile iron pipe and fitting product information, pipe laying schedule's and shop drawings for associated items.
4. High Density Polyethylene (HDPE) pipe and fitting product information for temporary bypass siphon lines.
5. Bypass siphon line laying schedule.
6. Associated items of work

Materials:

Ductile Iron Pipe and Fittings - Ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51.

Ductile and gray iron fittings, accessories and components shall conform to ANSI/AWWA C110/A21.10.

Mechanical joints shall conform to ANSI/AWWA C111/A21.11.

Ductile and gray iron fittings shall be supplied with glands, gaskets and tee head bolts and nuts for a complete assembly.

Ductile iron pipe and fittings shall be supplied with standard thickness cement lining conforming to ANSI/AWWA C104/A21.4.

Ductile iron pipe and fittings shall be supplied with an asphaltic coating conforming to AWWA C151 and AWWA C110.

Manufacturers:

1. American Ductile Iron Pipe
2. U.S. Pipe
3. Equivalent product approved by the Engineer

High Density Polyethylene Pipe and Fittings - HDPE pipe and fittings shall conform to AWWA C906-07, DR 19 IPS, Iron Pipe Size.

IPS stud end fitting for the Ductile Iron back up mating flange connection shall conform to ASTM D3261-03.

Portland Cement Concrete - Portland Cement Concrete shall conform to the requirements of Section 1020 of the Standard Specifications.

Portland Cement Concrete used for the Siphon Outlet Box construction shall be Class BS.

Portland Cement Concrete used for the siphon pipe encasement shall be Class DS.

Portland Cement Concrete used for the concrete plugs shall be Class BS.

Reinforcement Bars - Reinforcement Bars shall conform to the requirements of Section 508 of the Standard Specifications.

Threaded Reinforcement Splicing System - Threaded reinforcement splicing system shall conform to American Concrete Association ACI 318 code requirements for mechanical splices.

Manufacturers:

1. Lenton Taper Threaded Splices by ERICO
2. Threaded Splicing System by Dayton Superior
3. Equivalent product approved by the Engineer

Flexible Pipe Gasket Material - Flexible pipe gasket material shall conform to ASTM C990-09.

Manufacturers:

1. RAM-NEK by Henry Company
2. Kent Seal by Hamilton Kent
3. Equivalent product approved by the Engineer

Flexible Adhesive Waterstop Material - Flexible adhesive waterstop material shall conform to Federal Specification SSS-210.

Manufacturers:

1. Synko-Flex by Henry Company
2. Greenstreak
3. Waterstop-RX by CETCO
4. Equivalent product approved by the Engineer

PVC Waterstop Material - PVC waterstop material shall conform to Corps of Engineers CRD-C 572-74.

Manufacturers:

1. Greenstreak
2. Westec Barriers Technologies
3. Earth shield
4. Equivalent product approved by the Engineer

Method of Measurement. The work under this item will not be measured for payment. The quantities provided in the plans are for information only. The work to remove the existing siphon outlet junction chamber shall be measured according to the special provision REMOVAL OF EXISTING STRUCTURES in the contract specifications. The work to remove the existing 54" concrete siphon pipe shall be measured according to the special provision COMBINED SEWER REMOVAL in the contract specifications.

Basis of Payment. This work will be paid for at the contract lump sum price for SIPHON RECONSTRUCTION which price shall include all labor, excavation, backfilling, materials, and equipment necessary to execute the work as detailed in this specification. The work to remove the existing siphon outlet junction chamber shall be performed and paid for according to the special provision REMOVAL OF EXISTING STRUCTURES in the contract specifications. The work to remove the existing 54" concrete siphon pipe shall be performed and paid for according to the special provision COMBINED SEWER REMOVAL.

TEMPORARY EPOXY PAVEMENT MARKING

Description. This work shall consist of furnishing, installing, and maintaining Temporary Epoxy Pavement Markings.

Material. Materials shall be according to Article 1095.04 of the Standard Specifications.

Equipment. Equipment shall be according to Article 1105.02.

Construction Requirements. Prior to application a surface preparation adhesive shall be applied to a clean, dry road surface. The pavement shall be cleaned by a method of approved by the Engineer to remove all dirt, grease, glaze, or other material that would reduce the adhesion of the markings with minimum or no damage to the pavement surface. No markings shall be placed until the Engineer approves the cleaning. The Temporary Epoxy Pavement Marking shall be placed according to the applicable portions of Article 780.09.

Method of Measurement and Basis of Payment. This work will be paid for at the contract unit price per foot for TEMPORARY EPOXY PAVEMENT MARKING of the line width specified.

Removal will be paid at the contract unit price per square foot (square meter) for WORK ZONE PAVEMENT MARKING REMOVAL.

When temporary pavement marking is shown on the Standard, the cost of the temporary pavement marking will be included in the cost of the Standard.

RACKING CABLES IN MANHOLE OR HANDHOLE (CDOT)

Description. This item consists of providing labor and materials for racking of fiber optic cable in split innerduct and/or traffic signal and lighting copper cable around the inside perimeter of a manhole or handhole, in conformance with the Plans. In each manhole or handhole, the Contractor shall furnish and install at least four support brackets attached to the manhole walls, on which neatly coiled fiber optic cable in split innerduct and copper cable can be secured. The support brackets shall be attached firmly by screws drilled into the wall. Specific racking layout and components shall be provided in a submittal to the Engineer for each manhole or handhole, for review and approval in advance of installation.

In the event that a cable enclosure or other protective treatment of cable is used in place of racking on brackets at the direction of the Engineer, such alternate treatment shall be considered incidental to this pay item.

Method of Measurement. This Work will be measured on a per each basis for each manhole or handhole racked.

Basis of Payment. This Work will be paid for at the Contract Unit Price each per RACKING CABLES IN MANHOLE OR HANDHOLE (CDOT), which will be payment in full for the material and work described herein.

GROUND ROD, 3/4" DIA. X 10.0'-0" LENGTH (CDOT)

Description. This item consists of furnishing, installing, and connecting ground rods for the grounding of service neutral conductors and for supplementing the equipment grounding system via connections at lighting units, manholes, handholes, street lighting controllers, underpass lighting controllers, and traffic signal controllers throughout the system. All materials and Work must be in accordance with Article 250 of the NEC.

Materials. Materials must be according to the following Department of Electrical Operations (DEO) Specifications and Articles of Standard Specifications Section 1000 - Materials:

<u>Item</u>	<u>Requirement</u>
(a) Copper Ground Wire.....	DEO Specification No. 1440
(b) Ground Rod.....	DEO Specification No. 1465 and Standard Specifications, Article 1087.01

General Requirements. General requirements must be in accordance with Section 801 of the Standard Specifications, and in accordance with Department of Electrical Operations Standards and the City of Chicago Electrical Code, except as herein modified.

Installation. Ground rods must be driven so that the tops of the rod are 24 inches below finished grade, unless noted otherwise on the Contract Drawings. Where indicated, ground rods must be installed through concrete foundations or manholes. Where ground conditions, such as rock, preclude the installation of the ground rod, the ground rod may be deleted with the prior approval of the Commissioner.

Ground rod connection must be made by approved clamps. Ground wire for connection to foundation steel, or as otherwise indicated, must be stranded uncoated bare copper, in accordance with the applicable requirements of ASTM Designation B-3 and ASTM Designation B-8 and must be included in this item. Unless otherwise indicated, the wire must not be less than No. 8 AWG.

The ground wire must be interconnected to the ground rod, reinforcing steel and anchor bolts at each foundation. All connections to ground rods, structural steel and anchor bolts must be made with approved clamp. Where such connections are made to insulated conductors, the connection must be wrapped with at least 4 layers of electrical tape extended 6 inches onto the conductor insulation.

Method of Measurement. Ground rods will not be paid for separately. Ground wires and connection of ground rods at lighting units, manholes, handholes, controller foundations, and wall mounted controllers will be included in the associated pay item.

Basis of Payment. This work will be not paid for separately.

ELECTRICAL MANHOLE, 3' X 4' X 4', 30" FRAME AND LID (CDOT)

Description. This item will consist of furnishing and installing an electrical manhole of the dimensions indicated with a 30" frame and lid.

Material. The concrete manhole must meet the applicable requirements of Material Specification 1528. The frame and lid must meet the requirements of Material Specification 1458. A 30" frame and lid must meet the requirements of Standard Drawing 874 and 10927. Bricks must meet the requirements of Article 1041 of the Standard Specifications. All other materials used must meet the appropriate material requirements of the Standard Specifications.

Method of Construction. The manhole will be a precast concrete structure, or, if conditions merit, a cast in place concrete structure, complete with cast iron frame and lid. The manhole with a 30" frame and lid must conform to Drawing 729. The number and size of conduit openings will be as shown on the construction plans.

Each manhole will be installed in paved sidewalk, earth parkway, or in pavement at the location specified on the construction plans or at a location as directed by the Resident Engineer.

The area where the manhole is to be placed must be properly excavated. All disposable material will be properly disposed of per Section 202.03 of the Standard Specifications. Each manhole must be set or constructed to conform with the appropriate City of Chicago drawings, except that the number and size of conduit openings will be in accordance with the construction plans. The frame casting must be accurately set on a full bed of mortar to the finished elevation so that no subsequent adjustment will be necessary. Mortar and brick, or mortar and concrete rings, may be used to adjust to the proper grade. Adjustment rings, bricks, and frames must be set in a full mortar bed. Use of partial bricks will not be allowed. Bricks must be laid in full header courses only. In no instance will the neck of the manhole exceed two (2) feet in height. Mortar will be mixed in a proportion of one (1) part cement to three (3) parts sand by volume of dry materials. After entering laterals have been installed in place in the manhole, the openings in the wall must be plugged in an approved manner flush with the inner surface. If backfill is required, screenings must be used and properly compacted. Parkway must be restored to the proper grade. Pavement must be restored to the correct grade. Patching of the pavement must be done with high early strength concrete meeting the requirements of Articles 1001 and 1020 of the Standard Specifications. Sidewalks must be restored to the proper grade using a 5 inch thickness of concrete. The inside of the manhole must be clean of all debris.

Method of Measurement. This item will be measured per each unit installed.

Basis of Payment. The unit price for installing manholes will include necessary excavation, backfilling and restoration of parkway and pavement in accordance with the foregoing specifications. No additional payment will be allowed for restoring parkway or the restoration of sidewalk or pavement. Removal of sidewalk or pavement will be covered by separate pay items. New conduit, if necessary, will also be paid for separately. The unit cost will be for complete installation for each unit for ELECTRICAL MANHOLE, 3' X 4' X 4', 30" FRAME AND LID (CDOT).

LIGHT POLE, ALUMINUM, 18 FT. M.H., 8 FT. DAVIT ARM

LIGHT POLE, ALUMINUM, 18 FT. M.H., 8 FT. DAVIT ARM - TWIN

Description. This item will consist of furnishing, installing and setting plumb an aluminum anchor base pole with a single or twin 8 foot aluminum davit arm(s) on which a street light luminaire(s) will be attached. The pole will be set on a separate foundation and affixed with anchor rods or bolts. The davit arm(s) will be attached to an aluminum pole constructed to accept the arm(s).

Material. The pole must meet the requirements of Material Specification 1452. In addition, the residential pole must meet the requirements and dimensions of Standard Drawing 940. The mast arm must meet the requirements of Material Specification 1453. The mast arm must meet the requirements and dimensions of Standard Drawing 945. The davit arm(s) will have a 4.5 inch outside diameter at the base, where it slips over the top of the pole.

Installation. The pole must be installed on a concrete foundation or a steel helix foundation designed for the particular pole usage. When using double-nut construction please follow the details as shown on Standard Drawing 837. Double nut construction provides proper ventilation, as well as providing a way to plumb the pole. When using a helix foundation, double nutting is not feasible. Any exposed portions of anchor rods extending above the nuts which interfere with the installation of the bolt covers must be cut off to provide the necessary clearance. The excess must not be burned off. The pole must be set secure and plumb using the nuts and washer provided with the foundation pay item. The bolt covers, and handhole cover must be securely attached. The pole must be properly orientated in relation to the street, so that the davit arm will be perpendicular to the direction of the roadway.

The mast arm(s) must be installed on the aluminum pole as shown on the standard drawing. The davit arm assembly must be attached to the pole by slipping the arm assembly over the top of the pole and securing the arm to the pole with two stainless steel hex-head bolts.

Method of Measurement. This item will be measured per each light pole with mast arm(s) installed, complete. Work will consist of attaching the pole to the foundation, application of nut covers, attachment of handhole door, plumbing of the pole and attaching either a single or twin davit arm to the pole.

Basis of Payment. This work will be paid for at the Contract unit price each for LIGHT POLE, ALUMINUM, 18 FT. M.H., 8 FT. DAVIT ARM or for LIGHT POLE, ALUMINUM, 18 FT. M.H., 8 FT. DAVIT ARM - TWIN which will be payment in full for furnishing and installing the pole complete in place with davit arm(s). Bolt covers and the hand hole door will be included as incidentals. The light standard foundation (including nuts and washers), and luminaire will not be included in this pay item but will be paid for separately.

REMOVAL OF ETU BOLLARD FOUNDATION

Description. This item consists of the removal and disposal of existing ETU bollard foundations and associated power and data junction boxes, conduit and cables.

The concrete foundations must be removed completely and the material disposed of according to Article 202.03.

The power and data junction boxes shall be removed and disposed of properly including the conduits routed between the foundation and junction boxes.

Underground conduits and cables shall be removed to a depth of 2.5 foot below ground level. Cables and conduit shall become property of the Contractor and disposed of properly offsite.

The void caused by the removal of the foundation shall be backfilled according to Article 841.02.

Method of Measurement. Each foundation which is removed and disposed of as indicated will be counted as a unit of payment.

Basis of Payment. This work will be paid for at the contract unit price each for REMOVAL OF ETU BOLLARD FOUNDATION.

ROD AND CLEAN DUCT IN EXISTING CONDUIT SYSTEM(CDOT)

Description. This work will consist of inserting a duct rod or electrical fish rod or tape of sufficient length and rigidity into an electrical conduit opening in one electrical manhole or handhole, and pushing the said rod through the conduit to emerge at the next or subsequent manhole in the conduit system at the location shown on the plans. The duct rod may be inserted and removed by any standard construction method which causes no damage to the conduit system. The size of the conduit may vary from two inch (2") to four inch (4"), but there will be no differentiation in cost for the size of the conduit.

The conduit system which is to be rodded and cleaned may exist with various amounts of standing water in the manholes. The contractor must pump the water or sufficient water from the manholes to drain the conduit and to afford compatible working conditions for the installation of the duct rods and/or cables. The pumping of the manholes will be incidental to the work of rodding and cleaning of the conduit.

Any manhole which, in the opinion of the Resident Engineer contains excessive debris, dirt or other materials to the extent that conduit rodding and cleaning is not feasible, will be cleaned at the Engineer=s order and payment approved as a separate pay item, and not a part of this specification.

Prior to removal, of the duct rod, a duct cleaning attachment such as a properly sized wire brush or cleaning mandrel must be attached to the duct rod, which by removal of the duct rod will be pulled through the conduit to remove sand, grit, or other light obstructions from the duct to provide a clean, clear passage for the installation of cable. Whenever the installation of cables is not performed as an adjunct to or immediately following the cleaning of the duct, a light weight pulling line such as a 1/8" polyethylene line or conduit measuring tape must be placed and will remain in the conduit to facilitate future work. When great difficulty of either inserting the duct rod or removal of the cleaning mandrel is encountered, the duct may require further cleaning by use of a compressed air gun, or a low pressure water hose. In the case of a broken duct line, the conduit must be excavated and repaired. The existence and location of breaks in the duct line may be determined by rodding, but the excavation and repair work required will not be a part of this pay item.

Method of Measurement. This work will be measured per lineal foot for each conduit cleaned. Measurements will be made from point to point horizontally. No vertical rises will count in the measurement.

Basis of Payment. This work will be paid for at the contract unit price per lineal foot for ROD AND CLEAN DUCT IN EXISTING CONDUIT SYSTEM(CDOT) for the installation of new electric cables. Such price will include the furnishing of all necessary tools, equipment, and polyethylene line as required to prepare a conduit for the installation of cable. When the number of cables to be installed requires the use of more than one conduit in the same run, each additional conduit required will be rodded and cleaned as a separate unit and paid for at the contract unit price.

MAINTENANCE OF TRANSIT OPERATIONS (CTA)

Description. This item consists of providing all labor and materials required for the maintenance of transit operations where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation associated with the maintenance of transit operations work shall be as described in CTA MASTER SPECIFICATIONS:

SECTION 02 10 00 - MAINTENANCE OF TRANSIT OPERATIONS

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing MAINTENANCE OF TRANSIT OPERATIONS (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for MAINTENANCE OF TRANSIT OPERATIONS (CTA) which will be payment in full for maintenance of transit operations work as required by the CTA specifications and as indicated on the drawings.

CONCRETE (CTA)

Description. This item consists of providing all labor and materials required for installation of concrete reinforcement and cast-in place concrete at new elevator pit, interface with the existing platform, new slab at the station level and where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the cast-in place concrete and concrete reinforcement shall be as described in CTA MASTER SPECIFICATIONS:

SECTION 03 01 30 – MAINTENANCE OF CAST IN- PLACE CONCRETE SECTION 03 20 00 - CONCRETE REINFORCEMENT SECTION 03 30 00 - CAST-IN-PLACE CONCRETE SECTION 03 31 10 – LATEX CONCRETE OVERLAY SECTION 03 40 00 – PRECAST CONCRETE SECTION 03 61 11 – NON SHRINK GROUT

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing CONCRETE (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for CONCRETE (CTA) which will be payment in full for cast-in place concrete and concrete reinforcement work as required by the CTA specifications and as indicated on the drawings.

DEMOLITION (CTA)

Description. This item consists of providing all labor and materials required for demolition, removal and disposal of the structural boarding platform, platform canopy and station level components as indicated on the drawings including but not limited to: platform slab, longitudinal and transverse concrete beams, a steel stair, and aluminum canopy columns, portion of platform canopy and station structural elements and finish materials. Included are existing furniture, existing stationhouse skylights, exterior glass wall panels, and mechanical, plumbing, electrical and communications items to be removed, salvaged or relocated as a result of the demolition work.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The work includes the removals of the portions of the platform, platform canopy and the station as described in CTA MASTER SPECIFICATIONS:

SECTION 02 05 00 – DEMOLITION
SECTION 02 15 00 – TEMPORARY SHORING
SECTION 02 61 00 - CONTAMINATED SOIL REMOVAL AND DISPOSAL

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing DEMOLITION (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for DEMOLITION (CTA) which will be payment in full for labor and materials for demolition work as required by the CTA specifications and as indicated on the drawings.

STRUCTURAL STEEL AND METAL DECK (CTA)

Description. This item consists of providing all labor and materials required for installation of structural steel and metal deck for expansion of stationhouse and elevator hoistway, and where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the structural steel and metal deck shall be as described in CTA MASTER SPECIFICATIONS

SECTION 05 10 30 - STRUCTURAL STEEL
SECTION 05 31 00 – METAL DECK

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing STRUCTURAL STEEL AND METAL DECK (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for STRUCTURAL STEEL AND METAL DECK (CTA) which will be payment in full for structural steel and metal deck work as required by the CTA specifications and as indicated on the drawings.

STATION RENOVATION (CTA)

Description. This item consists of the renovation of the existing stationhouse, new stair/elevator landing, including exterior roof and wall enclosure and interior walls, ceilings, restoration of floor; and providing all labor and materials required for installation of masonry, metals, wood, plastics and composites, thermal and moisture protection, openings, finishes, specialties, equipment, furnishings and special construction work where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the masonry, metals, wood, plastics and composites, thermal and moisture protection, openings, finishes, specialties, equipment, furnishings and special construction work shall be as described in CTA MASTER SPECIFICATIONS:

DIVISION 4 – MASONRY WORK
DIVISION 5 – METALS WORK (excluding structural steel and metal deck indicated above)
DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES WORK
DIVISION 7 – THERMAL AND MOISTURE PROTECTION WORK
DIVISION 8 – OPENINGS WORK
DIVISION 9 – FINISHES WORK
DIVISION 10 – SPECIALTIES WORK
DIVISION 11 – EQUIPMENT WORK
DIVISION 12 – FURNISHINGS WORK
DIVISION 13 – SPECIAL CONSTRUCTION WORK

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installation of the STATION RENOVATION (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for STATION RENOVATION (CTA) which will be payment in full for masonry, metals, wood, plastics and composites, thermal and moisture protection, openings, finishes, specialties, equipment, furnishings and special construction work as required by the CTA specifications and as indicated on the drawings.

ELEVATOR (CTA)

Description. This item consists of providing all labor and materials required for installation of an electric traction elevator where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the electric traction elevator shall be as described in CTA MASTER SPECIFICATIONS:

SECTION 14 21 00 - ELECTRIC TRACTION ELEVATOR

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing ELEVATOR (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for ELEVATOR (CTA) which will be payment in full for electric traction elevator work as required by the CTA specifications and as indicated on the drawings.

MECHANICAL AND PLUMBING (CTA)

Description. This item consists of providing all labor and materials required for installation of mechanical and plumbing work where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the mechanical and plumbing work shall be as described in CTA MASTER SPECIFICATIONS:

DIVISION 22 – PLUMBING WORK

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING WORK

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing MECHANICAL AND PLUMBING (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for MECHANICAL AND PLUMBING (CTA) which will be payment in full for mechanical and plumbing work as required by the CTA specifications and as indicated on the drawings.

ELECTRICAL AND COMMUNICATIONS (CTA)

Description. This item consists of providing all labor and materials required for installation of electrical and communications work where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the electrical and communications work shall be as described in CTA MASTER SPECIFICATIONS:

DIVISION 26 – ELECTRICAL WORK
DIVISION 27 – COMMUNICATIONS WORK
SECTION 36 12 50 – UNDERGROUND TRACTION POWER CABLES
SECTION 37 84 00 – SIGNAL CABLE

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing ELECTRICAL AND COMMUNICATIONS (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for ELECTRICAL AND COMMUNICATIONS (CTA) which will be payment in full for electrical and communications work as required by the CTA specifications and as indicated on the drawings.

EARTHWORK, MICROPILES AND DRILLED SHAFTS (CTA)

Description. This item consists of providing all labor and materials required for installation of earthwork, micropiles and drilled shafts where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the earthwork, micropiles and drilled shafts work shall be as described in CTA MASTER SPECIFICATIONS:

DIVISION 31 – EARTHWORK WORK
SECTION 02 25 80 – MICROPILES
SECTION 02 45 00 – DRILLED SHAFTS

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing and installing EARTHWORK, MICROPILES AND DRILLED SHAFTS (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for EARTHWORK, MICROPILES AND DRILLED SHAFTS (CTA) which will be payment in full for earthwork, micropiles and drilled shafts work as required by the CTA specifications and as indicated on the drawings.

RELOCATION OF DUCT BANK (CTA)

Description. This item consists of providing all labor and materials required for relocation of duct bank where indicated on the drawings.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of the earthwork, exterior improvements and utilities work shall be as described in CTA MASTER SPECIFICATIONS:

SECTION 27 08 43 – UNDERGROUND DUCTS AND RACEWAYS FOR
COMMUNICAITON SYSTEMS

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for RELOCATION OF DUCT BANK (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for RELOCATION OF DUCT BANK (CTA) which will be payment in full for relocation of duct bank work as required by the CTA specifications and as indicated on the drawings.

BALLASTED TRACK CONSTRUCTION (CTA)

Description. This item consists of providing all labor and materials required for removal and replacement of certain sections of the CTA track to perform the new foundation work.

All materials and work must comply with the CTA Master Specifications.

Materials and Installation. The materials and installation of removal and replacement of certain sections of the CTA track work shall be as described in CTA MASTER SPECIFICATIONS:

SECTION 34 11 00 – BALLASTED TRACK CONSTRUCTION (CTA)

and as indicated on the drawings.

Method of Measurement. This item of work will be measured on a lump sum basis for BALLASTED TRACK CONSTRUCTION (CTA).

Basis of Payment. This work will be paid for at the contract lump sum price for BALLASTED TRACK CONSTRUCTION (CTA) which will be payment in full for ballasted track construction work as required by the CTA specifications and as indicated on the drawings.

EXPLORATORY TRENCHING (CTA)

Description. This work consists of trench excavation and by the Contractor for the purpose of locating unknown objects and unforeseen conflicts in the right-of-way between the westbound CTA tracks and the existing barrier wall for westbound I-290. This work also includes the area under the existing CTA platform in the vicinity of where temporary shoring and new foundation construction is proposed.

General: The work shall be performed according to Section 213 of the Standard Specifications. The exploration trench(s) shall be constructed at a location(s) as directed by the Engineer.

The trench shall be deep enough to expose the underground line, and the width of the trench shall be sufficient to allow proper investigation to determine if the line is in conflict with the current or future proposed improvements. Any necessary bracing and/or earth retention system needed should be included as part of the work.

Requirements. After Engineer's inspection of the trench area, it shall be backfilled with either excavated material or trench backfill at the Engineer's direction. All spoil generated by backfilling with trench backfill will be removed daily by the Contractor at their expense. Exploration trench minimum depth can be expected up to 4 feet from the existing ground except at existing handholes and manholes where there are no obstructions to the proposed new connections to these structures. The depth of the exploratory trench in the vicinity of the two new proposed manholes should be excavated to the depth required for these two structures.

Method of Measurement. The exploration trench will be measured for payment in feet of actual trench constructed. It is the Contractor's responsibility to determine the vertical locations of utilities. This will not be measured for payment. Trench Backfill, if required, will be measured in accordance with Article 208.03 of the Standard Specifications. An estimated length of exploration trench is inc

cluded in the summary of quantities to establish a unit price only.

Basis of Payment. This work shall be paid for at the contract unit price per foot for EXPLORATORY TRENCHING (CTA) as herein specified. If required, granular backfill will be paid for at the contract unit price for TRENCH BACKFILL.

SOIL RETENTION SYSTEM

Description. This work shall consist of designing, furnishing, installing and adjusting for stage construction where required the soil retention system according to the dimensions and details as shown on the Plans and in the approved design submittal. The system shall remain in place at the end of the contract.

General Requirements. The soil retention system shall be designed by the Contractor to retain the exposed surface area and all expected surcharge loads thereon as specified in the Plans or as directed by the Engineer. Requirements shall also follow special provision "TEMPORARY SOIL RETENTION SYSTEM," as wherein.

The design calculations and details for the soil retention system proposed by the Contractor shall be submitted to the Engineer for approval. The calculations shall be prepared and sealed by an Illinois Licensed Structural Engineer. This approval will not relieve the Contractor of responsibility for the safety of the excavation. Approval shall be contingent upon acceptance by all involved utilities and/or railroads.

The design shall consider the restrictions on the installation of all components of the soil retention system. These installation restrictions are listed in the next section of this special provision and in the "CONSTRUCTION VIBRATION MONITORING" special provision.

Construction. The Contractor shall verify locations of all underground utilities before installing any of the soil retention system components or commencing any excavation. Any disturbance or damage to existing structures, utilities or other property, caused by the Contractor's operation, shall be repaired by the Contractor in a manner satisfactory to the Engineer at no additional cost to the Department. The soil retention system shall be installed according to the Contractor's approved design, or as directed by the Engineer, prior to commencing any related excavation. If unable to install the soil retention system as specified in the approved design, the Contractor shall have the adequacy of the design re-evaluated. Any reevaluation shall be submitted to the Engineer for approval prior to commencing the excavation adjacent to the area in question. The Contractor shall not excavate below the maximum excavation line shown in the approved design without the prior permission of the Engineer. Once installed by the Contractor and approved by the Engineer, the soil retention system shall remain in place and not be removed.

The approval of the equipment and procedure by the Engineer does not guarantee the performance in the field of the equipment will be acceptable. If, in the judgment of the Engineer, the noise and/or vibration effects exceed those required by the local residents, then the Contractor must halt production and find a remedy suitable to the Engineer. Threshold values for vibration monitoring are included in the special provision "CONSTRUCTION VIBRATION MONITORING." The costs incurred finding suitable equipment and procedures shall be included in the cost of this item. No additional costs shall be paid for this effort.

When an obstruction is encountered, the Contractor shall notify the Engineer and upon concurrence of the Engineer, the Contractor shall begin working to break up, push aside, or remove the obstruction. An obstruction shall be defined as any object (such as but not limited to, boulders, logs, old foundations etc.) where its presence was not obvious or specifically noted on the Plans prior to bidding, that cannot be driven or installed through or around, with normal driving or installation procedures, but requires additional excavation or other procedures to remove or miss the obstruction.

Method of Measurement. The soil retention system furnished and installed according to the Contractor's approved design or as directed by the Engineer will be measured for payment in place, in square feet. The area measured shall be the vertical exposed surface area envelope of the excavation supported by soil retention system.

Any soil retention system installed beyond those dimensions shown on the contract Plans or the approved Contractor's design without the written permission of the Engineer shall not be measured for payment but shall be done at the Contractor's own expense.

Basis of Payment. This item will be paid for at the contract unit price per square foot for SOIL RETENTION SYSTEM.

Payment for any excavation, related solely to the installation of the soil retention system and/or its components, shall not be paid for separately but shall be included in the unit bid price for SOIL RETENTION SYSTEM. Other excavation, performed in conjunction with this work will not be included in this item but shall be paid for as specified elsewhere in this contract.

Obstruction mitigation shall be paid for according to Article 109.04 of the Standard Specifications.

HOT DIP GALVANIZING FOR STRUCTURAL STEEL

Description. This work shall consist of surface preparation and hot dip galvanizing all structural steel specified on the Plans and painting of galvanized structural steel when specified on the Plans, except covered in the special provision for STRUCTURAL STEEL (CTA).

Materials. Fasteners shall be ASTM A 325 Type 1, High Strength bolts with matching nuts and washers.

Fabrication Requirements. To insure identification after galvanizing, piece marks shall be supplemented with metal tags for all items where fit-up requires matching specific pieces.

After fabrication (cutting, welding, drilling, etc.) is complete, all holes shall be deburred and all fins, scabs or other surface/edge anomalies shall be ground or repaired per AASHTO M 160. The items shall then be cleaned per Steel Structures Painting Council's Surface Preparation Specification SSPC-SP1 (Solvent Cleaning) and SSPC-SP6 (Commercial Blast Cleaning). All surfaces shall be inspected to verify no fins, scabs or other similar defects are present.

The Contractor shall consult with the galvanizer to insure proper removal of grease, paint and other deleterious materials prior to galvanizing.

Cleaning Structural Steel

If rust, mill scale, dirt, oil, grease or other foreign substances have accumulated prior to galvanizing, steel surfaces shall be cleaned by a combination of either:

- Caustic cleaning and cleaning according to SSPC-SP8 (Pickling) or
- Cleaning according to SSPC-SP1 (Solvent Cleaning) and SSPC-SP6 (Commercial Blast Cleaning).

Special attention shall be given to the cleaning of corners and reentrant angles.

Surface Preparation and Hot Dip Galvanizing

General. Surfaces of the structural steel specified on the Plans shall be prepared and hot dip galvanized as described herein.

Surface Preparation. A flux shall be applied to all steel surfaces to be galvanized. Any surfaces which will receive field-installed stud shear connectors shall not be galvanized within 2 in. (50 mm) of the stud location. Either the entire area receiving studs or just individual stud locations may be left ungalvanized. The following steel surfaces of bearings shall not be galvanized: stainless steel surfaces, surfaces which will be machined (except for fixed bearing sole plates), and surfaces which will have TFE, elastomer, or stainless steel parts bonded to them.

The cleaned surfaces shall be galvanized within 24 hours after cleaning, unless otherwise authorized by the Engineer.

Application of Hot Dip Galvanized Coating. Steel members, fabrications and assemblies shall be galvanized by the hot dip process in the shop according to AASHTO M 111.

Bolts, nuts, washers and steel components shall be galvanized in the shop according to ASTM F 2329.

All steel shall be safeguarded against embrittlement according to ASTM A 143. Water quenching or chromate conversion coating shall not be used on any steel work that is to be painted. All galvanized steel work shall be handled in such a manner as to avoid any mechanical damage and to minimize distortion.

Beams and girders shall be handled, stored and transported with their webs vertical and with proper cushioning to prevent damage to the member and coating. Members shall be supported during galvanizing to prevent permanent distortion.

Hot Dip Galvanized Coating Requirements. Coating weight, surface finish, appearance and adhesion shall conform to requirements of ASTM A 385, ASTM F2329, AASHTO M 111 or AASHTO M 232, as appropriate.

Any high spots of zinc coating, such as metal drip lines and rough edges, left by the galvanizing operation in areas that are to be field connected or in areas that are to be painted shall be removed by cleaning per SSPC-SP2 (Hand Tool Cleaning) or SSPC-SP3 (Power Tool Cleaning). The zinc shall be removed until it is level with the surrounding area, leaving at least the minimum required zinc thickness.

Shop assemblies producing field splices shall provide 1/8 in. (3 mm) minimum gaps between ends of members to be galvanized. At field splices of beams or girders, galvanizing exceeding 0.08 in. (2 mm) on the cross-sectional (end) face shall be partially removed until it is 0.04 in. to 0.08 in. (1 to 2 mm) thick.

Testing of Hot Dip Galvanized Coating. Inspection and testing of hot dip galvanized coatings shall follow the guidelines provided in the American Galvanizers Association publication "*Inspection of Products Hot Dip Galvanized After Fabrication*". Sampling, inspection, rejection and retesting for conformance with requirements shall be according to AASHTO M 111 or AASHTO M 232, as applicable. Coating thickness shall be measured according to AASHTO M 111, for magnetic thickness gage measurement or AASHTO M 232, as applicable.

All steel shall be visually inspected for finish and appearance.

Bolts, nuts, washers, and steel components shall be packaged according to ASTM F 2329. Identity of bolts, nuts and washers shall be maintained for lot-testing after galvanizing according to Article 505.04(f)(2) for high strength steel bolts.

A notarized certificate of compliance with the requirements listed herein shall be furnished. The certificate shall include a detailed description of the material processed and a statement that the processes used met or exceeded the requirements for successful painting of the surface, where applicable. The certificate shall be signed by the galvanizer.

Repair of Hot Dip Galvanized Coating. Surfaces with inadequate zinc thickness shall be repaired in the shop according to ASTM A 780 and AASHTO M 111.

Surfaces of galvanized steel that are damaged after the galvanizing operation shall be repaired according to ASTM A 780 whenever damage exceeds 3/16 in. (5 mm) in width and/or 4 in. (100 mm) in length. Damage that occurs in the shop shall be repaired in the shop. Damage that occurs during transport or in the field shall be repaired in the field.

After galvanizing, contact surfaces for any bolted connections shall be roughened by hand wire brushing or according to SSPC-SP7 (Brush-Off Blast Cleaning). Power wire brushing is not allowed.

All bolt holes shall be reamed or drilled to their specified diameters after galvanizing. All bolts shall be installed after galvanizing.

Surface Preparation and Painting

Surface Preparation. When galvanized steel surfaces are specified to be painted they shall be clean and free of oil, grease, and other foreign substances. Surface preparation necessary to provide adequate adhesion of the coating shall be performed according to ASTM D6386. Surface preparation shall include, but not be limited to the following:

- All galvanized steel surfaces that are to be painted shall be cleaned according to SSPC-SP1 (Solvent Cleaning). After cleaning, all chemicals shall be thoroughly rinsed from the surface with a suitable solvent. The steel shall be allowed to completely dry prior to coating application.
- All galvanized steel surfaces that are to be painted shall be checked for the presence of chromate conversion coating according to ASTM D 6386 Appendix X1. Surfaces where chromate conversion coating is found shall be cleaned according to the same appendix and blown down with clean, compressed air according to ASTM D 6386 Section 6.1.
- All galvanized steel surfaces that are to be painted shall be checked for the presence of wet storage stain. Surfaces where wet storage stain is found shall be cleaned, rinsed and completely dried according to ASTM D 6386 Section 6.2.
- Following galvanizing, thickness readings shall verify the acceptable thickness of the galvanizing according to AASHTO M111/ASTM A123.

Paint Requirements. The paint materials (epoxy intermediate coat and aliphatic urethane finish coat) shall meet the requirements of the Articles 1008.05(d) and (e) of the Standard Specification.

All paint materials for the shop and field shall be supplied by the same manufacturer, and samples of components submitted for approval by the Department, before use.

Paint storage, mixing, and application shall be according to Section 506 of the Standard Specifications and the paint manufacturer's written instructions and product data sheets. In the event of a conflict the Contractor shall advise the Engineer and comply with the Engineer's written resolution. Until a resolution is provided, the most restrictive conditions shall apply.

Shop Application of the Paint System. The areas to be painted shall receive one full coat of an epoxy intermediate coat and one full coat of an aliphatic urethane finish coat. The film thickness of each coat shall be according to Article 506.09(f)(2).

Construction Requirements. The contact surfaces of splice flange connections (mating flange faces and areas under splice bolt heads and nuts) shall be free of paint prior to assembly. If white rust is visible on the mating flange surfaces, the steel shall be prepared by hand wire brushing or brush-off blasting according to SSPC-SP7. Power wire brushing is not allowed.

After field erection, the following areas shall be prepared by cleaning according to SSPC-SP1 (Solvent Cleaning), tie- or wash-coated if applicable, and then painted or touched up with the paint specified for shop application (the intermediate coat and/or the finish coat):

- exposed unpainted areas at bolted connections
- areas where the shop paint has been damaged
- any other unpainted, exposed areas as directed by the Engineer.

Special Instructions. Painting Date/System Code. At the completion of the work, the Contractor shall stencil in contrasting color paint the date of painting the bridge and the paint type code from the Structure Information and Procedure Manual for the system used according to Article 506.10(i). The code designation for galvanizing is "V". If painting of the structural steel is not specified then the word "PAINTED" may be omitted, the month and year shall then correspond to the date the stencil is applied.

Basis of Payment. The cost of all surface preparation, galvanizing, painting and all other work described herein shall be considered as included in the unit price bid for the applicable pay items to be galvanized and painted, according to the Standard Specifications.

PRECAST CONCRETE DECK PANELS

Description. This work shall consist of the furnishing and placing of the precast concrete deck with ultra high performance concrete (UHPC) joints. The maturity method shall be used to estimate the in-place UHPC strength. The time required before removal of the forms and loading of the structure will be determined based on the estimated in-place UHPC strength.

Materials. Materials used in this work shall conform to Section 504 of the Standard Specifications and the following:

<u>Item</u>	<u>Article/Section</u>
(a) Reinforcement Bars, Epoxy Coated	1006.10
(b) Mechanical Connectors	1006.06
(c) Water	1002
(d) Fine Aggregate	1003
(e) Coarse Aggregate	1004
(f) Fillet Material.	1024.02 Nonshrink grout
(g) Steel Embedments. Steel embedments for the panel leveling devices and hold down devices shall be installed in the shop based upon the locations shown on the approved shop drawings.	
(1) Leveling Bolts	ASTM F568M, Class 4.6
(h) Mix Design Criteria	
28 Day Compressive Strength	5000 psi (Minimum)
Lifting Strength	3000 psi (Minimum)
(i) Joint Material UHPC. The material shall be Ultra High Performance Concrete, all components supplied by one manufacturer. Materials commonly used in UHPC are:	
• Fine aggregate	
• Cementitious material	
• Super plasticizer	
• Accelerator	
• Steel Fibers	

- (1) UHPC material shall meet the following, 28 days unless otherwise noted:
- a) Minimum Compressive Strength (ASTM C39)
 - 1) High Heat-Treated * ≥ 25 ksi
 - 2) Medium Heat-Treated 12 hours ** ≥ 12 ksi
 - 3) Not Heat-Treated 28 days ≥ 21 ksi
 - 4) Prism Flexural Tensile toughness (ASTM C1018; 12 in. span)
 $I_{30} \geq 48$
 - b) Long-Term Shrinkage (ASTM C157; initial reading after set)
 ≤ 766 microstrain
 - c) Chloride Ion Penetrability (ASTM C1202) ≤ 250 coulombs
 - d) Chloride Ion Penetrability (AASHTO T259; 1/2 in. depth)
 < 0.07 oz/ft³
 - e) Scaling Resistance (ASTM C672) $y < 3$
 - f) Abrasion Resistance (ASTM C944 2x weight; ground surface)
 < 0.025 oz. lost
 - g) Freeze-Thaw Resistance (ASTM C666A; 600 cycles)
RDM $> 96\%$
 - h) Alkali-Silica Reaction (ASTM C1260; tested for 28 days)
Innocuous

* High Heat-Treated - According to manufacturer's recommendation, temperature not to exceed 250°F.

** Medium Heat Treated temperatures not to exceed 120°F

Note 1: Results of all the tests above, conducted by an AASHTO accredited testing lab shall be submitted to the Department along with the installation drawings. Provide to the Department a list of bridge projects in which the proposed UHPC material has been used as joint fill between precast concrete elements (within or outside the USA). The Department reserves the right to reject a proposed UHPC material which lacks a proven track record in precast concrete joint filling in bridge applications.

- (j) Storage. The Contractor shall assure the proper storage of premix, fibers and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.
- (k) Acceptance Testing. Note: acceptance testing will be waived if the same material from the same supplier has already been tested according to this standard. The Contractor shall complete the testing of the UHPC a minimum of one month before placement of the joint. The testing sequence will include the submission of a plan for casting and testing procedures to the Department for review and approval followed by casting and testing according to the approved plan.

- (1) Casting and testing must include the following:
 - a) A minimum of 12 cylinders 3in. x 6 in. shall be cast.
 - b) The temperature during curing shall be as per heat treatment temperature limits established in this specification. 2 cylinders shall be tested each testing interval. Testing intervals are at 10 hours, 12 hours, 14 hours, and 24 hours. The compressive strength shall be measured by ASTM C39. Only a concrete mix design that passes these tests may be used to form the joint.
 - c) Pullout Test: Cast 6 additional cylinders 12 in. diameter and 7.5 in. deep. Each cylinder shall have one 32 in. long epoxy-coated reinforcing bar cast in the center of the circular face. The axis of the bar shall be perpendicular to the formed surface. 3 of the bars shall be #6 bars embedded 5 in. deep and 3 of the bars shall be #4 bars embedded 3 in. deep. These cylinders will be kept wet for four days then delivered to the Bureau of Materials for testing as specified by the Bureau of Materials. Contact the Bureau of Materials prior to casting for specific instructions on preparing the test specimens. The test will be performed as soon as practical after the corresponding compressive strength samples reach 14.5 ksi. Acceptance criteria for pullout testing shall be when there is complete tensile failure of the reinforcing bar, prior to pullout from the concrete or failure of the concrete.

Testing

- (a) Equipment for Maturity Testing. Use a Maturity Meter and thermocouples that can:

- (1) Provide a maturity value based on the Equivalent Age or Temperature Time Method as detailed in ASTM C 1074-11.
- (2) Continuously log and store maturity data.
- (3) Accurate to within +/- 1° F when the meter is calibrated as per the manufacturer=s instructions.
- (4) Take readings every half hour for the first 48 hours and every hour after that at a minimum.
- (5) Print data and/or download it into a spreadsheet.

- (b) Methodology for Maturity Testing.

The procedure for utilizing the maturity method to determine in-place UHPC strengths includes three steps: development of the strength-maturity relationship, monitoring the maturity of the placement, and regular validation of the strength maturity relationship. Any changes in the mix design, its components, or proportions will require that a new strength-maturity relationship be developed.

The strength-maturity relationship shall be developed one month prior to construction. Continue data collection for the strength-maturity relationship after acceptance of the maturity value until the strength reaches 14.5 ksi.

A procedure to develop the strength-maturity relationship shall be submitted to the Department for review and approval along with the shop drawings. The submitted procedure shall include all necessary information for the development of the strength maturity relationship. All necessary testing included in the procedure shall be conducted by an AASHTO accredited testing lab.

Construction Requirements:

(a) Drawings for Precast Concrete Panels. Shop drawings and installation drawings shall be prepared and submitted as per the requirements of the Standard Specifications, and the following:

(1) The submitted drawings shall include details of lifting and handling of panels in the production facility and their storage, transportation, handling and storage at the construction site. Lifting holes will not be permitted. The proposed handling and lifting shall be such that the maximum tensile stress in concrete due to handling and erection loads shall not exceed $0.40 (f'ci)^{1/2}$, where $f'ci$ is the concrete compressive strength at the time being considered. Calculations showing actual concrete stresses based upon the proposed support locations and expected dynamic loading of the panels during handling, storage and transportation of the panels shall be prepared by an Illinois Licensed Structural Engineer and shall be submitted along with the drawings. These drawings and calculations shall be stamped and signed by an Illinois Licensed Structural Engineer.

(2) The proposed method of mixing, placing, and curing the UHPC joints shall be shown on the installation drawings. The Contractor shall perform qualification testing using maturity method and the results shall be shown on the installation drawing to demonstrate that the proposed method of curing will achieve the required strength at the required time.

(b) Fabrication of Precast Concrete Panels. Fabrication shall meet the requirements of the Standard Specifications and the following:

1) Fabrication Tolerances.

(a) Width (transverse direction of the bridge): +1/8, -1/8 in.

(b) Length (longitudinal direction of the bridge): +1/8, -1/8 in.

(c) Depth (overall): +1/8, -0 in.

(d) Bulkhead alignment (deviation from square or designated skew)

a) Vertical 1/4 in.

b) Horizontal 1/4 in.

(e) Horizontal alignment (deviation from straight line parallel to centerline of unit):

a) 1/4 in. for 40 ft length

b) 3/8 in. for 40 ft to 60 ft length

c) 1/2 in. for greater than 60 ft length

2) Placing Concrete, Curing and Finishing. All requirements stipulated in the Standard Specifications shall apply except for the following:

- a) After curing, all form release material and all other forming material adhering to the shear keyway and block out concrete shall be removed. Shear key faces shall be roughened and blast cleaned.
- 3) Shipping and Handling of Precast Panels. Shall be as per approved drawings.
- 4) Loading of Panels. Equipment weighing more than 2500 pounds shall not be permitted on the precast units between the initial set of the UHPC and the time the UHPC has reached a minimum strength of 10 ksi.
- 5) Mixing and Placing UHPC Joints and Fillets. The specifications in the Manual for Fabrication of Precast Prestressed Concrete Products and the following:
 - a) Thoroughly and continuously wet the concrete contact area prior the placing of UHPC, keep wet and remove all surface water just prior to UHPC placement.
- (c) Installation Requirements for Deck Slabs. Installation shall meet the requirements of the Standard Specifications and the following:
 - 1) Prior to installing panels, the supporting steel surfaces in contact with the panels or field placed concrete shall be cleaned, including removal of free water, to the satisfaction of the Engineer.
 - 2) Installation tolerances shall be as per the approved installation drawings. It is the responsibility of the Contractor to develop appropriate controls during the fabrication and installation of the panels so that proper cross slopes and grades are achieved. Installation drawing shall show the details of the proposed controls.
- (d) Installation Requirements for UHPC. The Contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of the joints until the Contractor's own staff has become well-trained in the use of the material. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.
- (e) Grouting of Fillets. Grouting shall meet the requirements of the Standard Specifications. Details of grouting ports, vents, method of pumping the grout, equipment with necessary back up shall be shown on the installation drawing. Required QC for the grouting also shall be listed on the drawings.
- (f) Pre-installation Meeting. Convene a pre-placement meeting 7 to 14 calendar days before the planned start of slab installation. The Contractor shall arrange for an on site meeting with representatives from the UHPC and the precast system suppliers. The Contractor's staff and the Engineer and Inspectors shall attend the site meeting. The objective of the meeting will be to clearly outline the procedures for placing and leveling the precast concrete panels and for mixing, transporting, finishing and curing of the UHPC material.

- 1) Form Work, Batching and Curing. The design and fabrication of forms shall follow approved installation drawings and shall follow the recommendations of the manufacturer. All the forms for UHPC shall be constructed from plywood or approved equal. The forms shall be coated to prevent absorption of water using a form release agent. Form release agents shall be compatible with all curing agents and admixtures.
- 2) The Contractor shall follow the batching sequence as specified by the supplier and approved by the Department. The surface of the UHPC field joints shall be filled as shown on the approved drawings.
- 3) The UHPC in the form shall be cured according to Manufacturer's recommendations to attain the required strength shown on the contract documents.

Quality Control. The Contractor shall measure the slump flow on each batch of UHPC. The slump flow will be conducted using a mini-slump cone. The flow for each batch shall be between 7 in. and 10 in. The slump flow for each batch shall be recorded in the QA/QC log. A copy of the log shall be given to the Engineer.

a) Estimation of In-Place Strength.

- 1) Two thermocouples per each UHPC joints, one at each end, shall be installed. The locations of these installations shall be shown on the installation drawings. These locations shall be revised if directed by the Department. The thermocouple wiring may be connected to reinforcing steel, but probe endings may not be in direct contact with the steel. Consider structural or exposure conditions when placing thermocouples.
- 2) Listed actions are allowed when the maturity value of all the thermocouples reaches the corresponding strength values listed below.

Action	Strength Requirement
Removal of top forms	10 ksi
Open Bridge deck to Traffic	14.5 ksi

- 3) Record and save the maturity data from the meter until the strength reaches 14.5 ksi. Disconnect the meter and clip all wires flush with the concrete surface.

A continuous read thermocouple or thermistor with a data logger can be used to estimate in place strength. The methodology outlined in ASTM C 1074-11 will be used. The maturity function used to estimate strength will be calculated with the same formula that is used by the maturity meter that established the initial strength maturity relationship. Copies of the calculations will be provided to the Engineer.

- b) Validation of the Strength-Maturity Relationship. For each day of placement, perform validation tests by casting 7 cylinders. Equip one of the cylinders with a thermocouple. Test the cylinders as close as possible to the maturity value corresponding to 14.5 ksi. Record the maturity value immediately prior to testing. All testing shall be conducted by an AASHTO accredited testing lab. Report the results to the Department.
- 1) If the average value of compressive strength of each pair of cylinders is within 10% of the estimated value, the strength-maturity relationship will be validated. If the average cylinder value is more than 10% below the estimated value, the strength maturity relationship will need to be re-established. If the first four cylinders produce acceptable results, the remainder need not be tested.
 - 2) The Department may perform additional testing for research purposes. Casting and testing in addition to that required in this spec will be performed by Department personnel.
 - 3) In case of loss of required data, or non-verification of the strength-maturity relationship, use the cylinders cast above, one pair at a time, to verify the strength.

Method of Measurement. The Precast Concrete Deck Panels work will be measured in square feet.

Basis of Payment. Precast Concrete Deck Panels will be paid for at the contract unit price per square foot for PRECAST CONCRETE DECK PANELS.

The cost of the ultra high performance concrete joints and the cost of all testing for UHPC shall be included in the cost of PRECAST CONCRETE DECK PANELS.

BRIDGE DECK LATEX CONCRETE OVERLAY

This work shall consist of the preparation of a new concrete bridge deck and the construction of a latex overlay to the specified thickness.

Materials. Materials shall meet the following Articles of Section 1000:

<u>Item</u>	<u>Section</u>
(a) Latex/Portland Cement Concrete (Note 1) (Note 2)	1020
(b) Packaged Rapid Hardening Mortar or Concrete	1018
(c) Concrete Curing Materials	1022.02

Note 1. The latex admixture shall be a uniform, homogeneous, non-toxic, film-forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture. The latex admixture shall not contain any chlorides and shall contain 46 to 49 percent solids.

The Contractor shall submit a manufacturer's certification that the latex emulsion meets the requirements of FHWA Research Report RD-78-35, Chapter VI. The certificate shall include the date of manufacture of the latex admixture, batch or lot number, quantity represented, manufacturer's name, and the location of the manufacturing plant. The latex emulsion shall be sampled and tested in accordance with RD-78-35, Chapter VII, Certification Program.

The latex admixture shall be packaged and stored in containers and storage facilities which will protect the material from freezing and from temperatures above 85°F (30°C). Additionally, the material shall not be stored in direct sunlight and shall be shaded when stored outside of buildings during moderate temperatures.

Note 2. Cement shall be Type I portland cement. Fine aggregate shall be natural sand and the coarse aggregate shall be crushed stone or crushed gravel. The gradation of the coarse aggregate shall be CA 13, CA 14 or CA 16.

Mixture Design. The latex concrete shall contain the following approximate units of measure or volumes per cubic yard (cubic meter).

Type I Portland Cement	658 lb. (390 kg)
Latex Admixture	24.5 gal (121.3 L)
Coarse Aggregate	42 to 50 percent by weight (mass) of total aggregate
Water (including free moisture on the fine and coarse aggregates)	157 lb. (93.1 kg) maximum

No air entraining admixtures shall be added to the mix.

This mix design is based on a specific gravity of 2.65 for both the fine and the coarse aggregates. The mix will be adjusted by the Engineer to compensate for aggregate specific gravity and moisture.

The latex concrete shall meet the following requirements:

Slump shall be according to Article 1020.07 and 1020.12:	3 to 6 in. (75 to 150 mm)
Air Content shall be according to Article 1020.08 and 1020.12:	7 percent maximum
Water-cement ratio (considering all the nonsolids in the latex admixture as part of the total water)	0.30 to 0.40

Required Strength (Compressive)	4000 psi (27,500 kPa) minimum
Required Strength (Flexural)	675 psi (4,650 kPa) minimum

Equipment. The equipment used shall be subject to the approval of the Engineer and shall meet the following requirements:

- (a) Surface Preparation Equipment. Surface preparation equipment shall be according to the applicable portions of Section 1100 and the following:
 - (1) Mechanical Blast Cleaning Equipment. Mechanical blast cleaning shall be performed by high-pressure water blasting. Mechanical high-pressure water blasting equipment shall be mounted on a wheeled carriage and shall include multiple nozzles mounted on a rotating assembly, and shall be operated with a 7000 psi (48 MPa) minimum water pressure. The distance between the nozzles and the deck surface shall be kept constant and the wheels shall maintain contact with the deck surface during operation.
 - (2) Hand-Held Blast Cleaning Equipment. Blast cleaning using hand-held equipment shall be performed by high-pressure water blasting. Hand-held high-pressure water blasting equipment that is used in areas inaccessible to mechanical blast cleaning equipment shall have a minimum water pressure of 7000 psi (48 MPa).
 - (3) Vacuum Cleanup Equipment. The equipment shall be equipped with fugitive dust control devices capable of removing wet debris and water all in the same pass. Vacuum equipment shall also be capable of washing the deck with pressurized water prior to the vacuum operation to dislodge all debris and slurry from the deck surface.
- (b) Pull-off Test Equipment. Equipment used to perform pull-off testing shall be either approved by the Engineer, or obtained from one of the following approved sources:

James Equipment
007 Bond Tester
800-426-6500

Germann Instruments, Inc.
BOND-TEST Pull-off System
847-329-9999

SDS Company
DYNA Pull-off Tester
805-238-3229

Pull-off test equipment shall include all miscellaneous equipment and materials to perform the test and clean the equipment, as indicated in the Illinois Test procedure 304 and 305 "Pull-off Test (Surface or Overlay Method)". Prior to the start of testing, the Contractor shall submit to the Engineer a technical data sheet and material safety data sheet for the epoxy used to perform the testing. For solvents used to clean the equipment, a material safety data sheet shall be submitted.

- (c) Concrete Equipment. A mobile portland cement concrete plant shall be used for Latex Concrete and shall be according to Articles 1020.12, 1103.04 and the following:
 - (1) The device for proportioning water shall be accurate within one percent.
 - (2) The mixer shall be a self-contained, mobile, continuous mixer used in conjunction with volumetric proportioning.
 - (3) The mixer shall be calibrated prior to every placement of material or as directed by the Engineer.
- (d) Finishing Equipment. Finishing equipment shall be according to Article 503.03.
- (e) Mechanical Fogging Equipment. Mechanical fogging equipment shall be according to 503.03.

Construction Requirements. Sidewalks, curbs, drains, reinforcement and/or existing transverse and longitudinal joints which are to remain in place shall be protected from damage during cleaning operations. All damage caused by the Contractor shall be corrected, at the Contractor's expense, to the satisfaction of the Engineer.

The Contractor shall control the runoff water generated by the various construction activities in such a manner as to minimize, to the maximum extent practicable, the discharge of untreated effluent into adjacent waters, and shall properly dispose of the solids generated according to Article 202.03. The Contractor shall submit a water management plan to the Engineer specifying the control measures to be used. The control measures shall be in place prior to the start of runoff water generating activities. Runoff water shall not be allowed to constitute a hazard to adjacent or underlying roadways, waterways, drainage areas or railroads nor be allowed to erode existing slopes.

(a) Deck Preparation.

- (1) Bridge Deck Blast Cleaning. The blast cleaning operation shall consist of preparing the designated concrete deck surface using water blasting equipment as specified under Surface Preparation Equipment. The areas designated shall be blast cleaned to the depth specified on the plans. If a blast cleaning depth is not specified, a minimum of one eighth of an inch shall be required.

After water blasting, the deck shall be thoroughly vacuum cleaned in a timely manner before the water and debris are allowed to dry and re-solidify to the deck.

- (2) Final Surface Preparation. Any areas determined by the Engineer to be inaccessible to water blasting equipment shall be thoroughly water blasted with hand-held equipment.

If spoils from the blast cleaning operation are allowed to dry and re-solidify on the deck surface, the deck surface shall be cleaned again with blasting cleaning equipment and immediately vacuumed.

Final surface preparation shall also include the cleaning of all dust, debris, concrete fines and other foreign substances from the deck surface including vertical faces of curbs, previously placed adjacent overlays, barrier walls up to a height of 1 in. (25 mm) above the overlay, and depressions. Hand-held high-pressure water blasting equipment shall be used for this operation.

Surface pull-off testing shall be conducted at a frequency of one location per 2500 square feet. Testing shall be in according to the Illinois Test Procedure 304 "Pull-off Test (Surface Method)". The Contractor shall provide the test equipment. The Engineer shall determine each test location, and each individual test shall have a minimum strength of 175 psi (1,207 kPa). In the case of a failing test, the Contractor shall adjust the blast cleaning method and re-clean the area. Testing will be repeated until satisfactory results are attained.

All dust, concrete fines, debris, including water, resulting from the surface preparation shall be confined and shall be immediately and thoroughly removed from all areas of accumulation. If concrete placement does not follow immediately after the final blast cleaning, the area shall be carefully protected with well-anchored white polyethylene sheeting.

- (b) Pre-placement Procedure. Prior to placing the overlay, the Engineer will inspect the deck surface. All contaminated areas shall be blast cleaned again at the Contractor's expense. Before placing the overlay, the finishing machine shall be operated over the full length of bridge segment to be placed to check support rails for deflection and confirm the minimum overlay thickness. All necessary adjustments shall be made and another check performed, unless otherwise directed by the Engineer.
- (c) Testing. All testing shall be according to Check Sheet 31 of the Illinois Department of Transportation Supplemental Specifications and Recurring Special Provisions, except the frequency for slump testing by QC shall be revised to a minimum of one test per truck.
- (d) Placement Procedure. Concrete placement shall be according to Article 503.07 and the following:
 - (1) Bonding Method.

The deck shall be cleaned to the satisfaction of the Engineer and shall be thoroughly wetted and maintained in a dampened condition with water for at least 12 hours before placement of the overlay. Any excess water shall be removed by compressed air or by vacuuming prior to the beginning of overlay placement. Water shall not be applied to the deck surface within one hour before or at any time during placement of the overlay.

(2) Overlay Placement.

Placement of the concrete shall be according to Article 503.16.

Internal vibration will be required along edges, adjacent to bulkheads, and where the overlay thickness exceeds 3 in. (75 mm). Internal vibration along the longitudinal edges of a pour will be required with a minimum of 2 hand-held vibrators, one on each edge of the pour. Hand finishing will be required along the edges of the pour and shall be done from sidewalks, curbs or work bridges.

A construction dam or bulkhead shall be installed in case of a delay of 30 minutes or more in the concrete placement operation.

All construction joints shall be formed. When required by the Engineer the previously placed overlay shall be sawed full-depth to a straight and vertical edge before fresh concrete is placed. The Engineer will determine the extent of the removal. When longitudinal joints are not shown on the plans, the locations shall be subject to approval by the Engineer and shall not be located in the wheel paths.

The Contractor shall stencil the date of construction (month and year) and the letters LX into the overlay before it takes its final set unless directed otherwise by the Commissioner. The stencil shall be located in a conspicuous location, as determined by the Engineer, for each stage of construction. This location shall be outside of the grooving where possible and within 3 ft. (1 m) of an abutment joint. The characters shall be 3 to 4 in. (75 mm to 100 mm) in height, 1/4 in. (5 mm) in depth and face the centerline of the roadway.

(3) Limitations of Operations.

(a) Weather Limitations. Temperature control for concrete placement shall be according to 1020.14(b). The concrete protection from low air temperatures during the curing period shall be according to Article 1020.13(d). Concrete shall not be placed when rain is expected during the working period. If night placement is required, illumination and placement procedures will be subject to the approval of the Engineer. No additional compensation will be allowed if night work is required.

(b) Other Limitations. Concrete delivery vehicles driven on the structure shall not exceed the legal load limit of the structure.

Final blast cleaning and concrete placement on adjacent portions of the deck may proceed, provided the process does not interfere in any way with any other blast cleaning or placement operations.

Water or contaminants from blast cleaning operations shall not be permitted in areas where the new overlay has been placed until the overlay has cured a minimum of 24 hours.

No concrete shall be removed within 6 ft. (1.8 m) of a newly-placed overlay until the concrete has obtained a minimum compressive strength of 3000 psi (20,700 kPa) or flexural strength of 600 psi (4,150 kPa).

(4) Curing.

The minimum curing time shall be 48 hours of wet cure followed by 48 hours of dry cure. The wet cure shall be according to Article 1020.13(a)(5), except Cotton Mats shall be replaced with two layers of burlap that have been pre-dampened for a minimum of 12 hours. Excess water shall not be allowed to drip from the burlap onto the overlay during placement. After the wet cure is completed all layers of covering materials shall be removed to allow for the dry cure.

If the ambient temperature falls below 50°F (10°C) during either the wet or dry curing periods, the time below 50°F (10°C) will not be included in the 96 hour curing period. If there is sufficient rain to wet the surface of the overlay for more than one hour of the dry cure period, the wet time will not be included in the 48 hour dry cure period.

(5) Opening to Traffic.

No traffic or construction equipment will be permitted on the overlay until after the specified cure period and the concrete has obtained a minimum compressive strength of 4000 psi (27,500 kPa) or flexural strength of 675 psi (4,650 kPa).

At the Engineers discretion, no traffic or construction equipment will be permitted within 12 feet of any overlay until the overlay has obtained initial set, or the concrete has obtained a minimum compressive strength of 4000 psi (27,500 kPa) or flexural strength of 675 psi (4,650 kPa).

(6) Overlay Testing.

The Engineer reserves the right to conduct pull-off tests on the overlay to determine if any areas are not bonded to the underlying concrete. The overlay will be tested according to the Illinois Test procedure 305 "Pull-off Test (Overlay Method)", and the Contractor shall provide the test equipment. Each individual test shall have a minimum strength of 150 psi (1,034 kPa). Unacceptable test results will require removal and replacement of the overlay at the Contractor's expense, and the locations will be determined by the Engineer. When removing portions of an overlay, the saw cut shall be a minimum depth of 1 in. (25 mm).

If the overlay is to remain in place, all core holes due to testing shall be filled with a rapid set mortar or concrete. Only enough water to permit placement and consolidation by rodding shall be used, and the material shall be struck-off flush with the adjacent material.

For a rapid set mortar mixture, one part packaged rapid set cement shall be combined with two parts fine aggregate, by volume; or a packaged rapid set mortar shall be used. For a rapid set concrete mixture, a packaged rapid set mortar shall be combined with coarse aggregate according to the manufacturer's instructions; or a packaged rapid set concrete shall be used. Mixing of a rapid set mortar or concrete shall be according to the manufacturer's instructions.

Method of Measurement. The concrete overlay will be measured for payment in square yards (square meters).

Basis of Payment. Latex concrete overlay will be paid for at the contract unit price per square yards (square meters) for BRIDGE DECK LATEX CONCRETE OVERLAY, 2 1/4 INCHES.

When the Engineer conducts pull-off tests and they are acceptable, Contractor expenses incurred due to testing and for filling core holes will be paid according to Article 109.04. Unacceptable pull-off tests will be at the Contractor's expense.

APPENDIX A – CITY OF CHICAGO DEPARTMENT OF TRANSPORTATION DIVISION OF ELECTRICAL OPERATIONS

SUMMARY

This Appendix includes copies of technical documents which are made available to the Contractor as a convenience for informational purposes. The material specifications within this section apply only to the Chicago Department of Transportation (CDOT) Specifications which reference them.

<i>Document</i>	<i>Pages</i>
SPECIFICATION NO. 1351, WIRE: SINGLE CONDUCTOR NO. 12 COPPER WITH CROSS LINKED POLYETHYLENE INSULATION revised June 7, 2006, City of Chicago, Division of Electrical Operations	4
SPECIFICATION NO. 1452, POLE: ANCHOR BASE, ALUMINUM, TAPERED TUBULAR SHAFT revised December 2, 2009 City of Chicago, Division of Electrical Operations.....	8
SPECIFICATION NO. 1453, MAST ARMS: ALUMINUM, TRUSS TYPE AND DAVIT TYPE revised December 2, 2009 City of Chicago, Division of Electrical Operations.....	6
SPECIFICATION NO. 1458, ELECTRICAL MANHOLE FRAMES AND COVERS 24 INCH AND 30 INCH DIAMETER revised July 10, 2006 City of Chicago, Division of Electrical Operations	2
SPECIFICATION NO. 1462, RIGID STEEL CONDUIT (HOT DIPPED GALVANIZED) revised August 3, 2006, City of Chicago, Division of Electrical Operations	7
SPECIFICATION NO. 1465, GROUND RODS revised July 12, 2006 City of Chicago, Division of Electrical Operations	2
SPECIFICATION NO. 1467, ROD: ANCHOR, STEEL, WITH HARDWARE dated May 12, 1993 City of Chicago, Division of Electrical Operations	2
SPECIFICATION NO. 1524, LAMPS: HIGH PRESSURE SODIUM FOR STREET LIGHTING revised July 31, 2006 City of Chicago, Division of Electrical Operations	2
SPECIFICATION NO. 1528, PRECAST CONCRETE STRUCTURES revised May 1, 2004 City of Chicago, Division of Electrical Operations.....	3
SPECIFICATION NO. 1533, NON-METALLIC CONDUIT dated August 8, 2006 City of Chicago, Division of Electrical Operations.....	2
SPECIFICATION NO. 1534, CABLE: SINGLE CONDUCTOR, COPPER 600 VOLT dated September 25, 2006 City of Chicago, Division of Electrical Operations	6

SPECIFICATION NO. 1541, REINFORCING ROD FORMED STEEL CAGES
dated September 16, 2004 City of Chicago, Division of Electrical Operations 2

ELECTRICAL SPECIFICATION 1351

**DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED JUNE 7, 2006**

**WIRE: SINGLE CONDUCTOR NO. 12 COPPER WITH CROSS LINKED
POLYETHYLENE INSULATION**

SUBJECT

1. This specification states the requirements for insulated wire intended for use as a conductor to connect street light luminaires to aerial distribution wires or underground distribution cables in a street lighting circuit. This wire is also known as pole wire.

GENERAL

2. (a) Specifications. The cable shall conform in detail to the requirements herein stated and to the referenced specifications of the American Society for Testing and Materials (ASTM), the National Electric Code (NEC), Underwriters Laboratories (UL), the Insulated Cable Engineers Association (ICEA), and the National Electrical Manufacturers Association (NEMA), in which the most recently published revisions will govern.
- (b) Acceptance. Cable not conforming to this specification will not be accepted.
- (c) Sample. If requested by the Chief Procurement Officer, a three (3) foot sample of the cable intended to be provided under this specification, shall be submitted to the Engineer of Electricity within fifteen (15) business days after receipt of the request.
- (d) Warranty. The manufacturer shall warrant the cable to be first class material throughout. The manufacturer will be responsible for any cable failing during normal and proper use within one (1) year after the date of installation. The manufacturer will provide replacement of any failed cable segment, from the point of normal termination to the next point of normal termination. There will be no cost to the City.

CABLE

3. (a) **Construction.** The cable shall consist of a coated copper conductor concentrically encased in a moisture resistant thermosetting plastic of cross linked polyethylene. The cable shall be listed with UL as Type RHW-2 or Type USE-2, and shall meet the NEC's requirements for these types of cable up to 90° C in wet or dry locations.
- (b) **Sealing.** Both ends of each length of cable must be thoroughly sealed to prevent the entrance of moisture and other foreign matter.
- (c) **Color.** All cables must use a carbon black pigmented cross linked polyethylene compound. Any other color must be an approved, permanent type coating applied to the carbon black insulation.
- (d) **Marking.** The cable must be identified by a permanently inscribed legend in white lettering. The legend must have the following information at a minimum: 1/C #12AWG, 600V, XLPE, 90°, RHW-2 or USE-2, manufacturer's name, date of manufacture. The legend must be repeated at approximately eighteen inch (18") intervals parallel to the longitudinal axis of the cable.

CONDUCTOR

4. (a) **Material.** Conductor shall be Number 12 AWG consisting of seven (7) strands of coated, annealed, copper wires (.0305 inch diameter) per ASTM-8, Class B.
- (b) **Resistivity.** Conductor shall conform to the requirements of ASTM B-33.
- (c) **Coating.** Conductor shall be tin coated in accordance with ASTM B-33.

INSULATION

5. (a) **Type.** The insulation shall be a cross linked polyethylene compound meeting the physical and electrical requirements herein specified and the requirements of NEMA WC-70 (ICEA S-95-658).
- (b) **Thickness.** The insulation must be circular in cross section and have an average thickness of 45 mils. The thickness must not vary by more than plus or minus five percent (+/-5%).

(c) Physical Properties

Initial Values:

Tensile strength, minimum psi	2000
Elongation at rupture, minimum %	250

TESTS

6. (a) General. The tests required to determine compliance with this specification must be certified by the manufacturer or an independent testing facility. Before shipment, copies of the test reports must be forwarded to the Division of Engineering for approval. The City reserves the right to reject any cable failing to meet the requirements of the tests. Tests must be made in accordance with methods in ASTM D-470.

(b) Physical Properties

After Aging:

1. After 168 hours in oxygen bomb at a pressure of 80 psi and a temperature at $127^{\circ} \pm 1^{\circ} \text{C}$:

Tensile strength, minimum % of initial value	75
Elongation at rupture, minimum % of initial value	75

2. After 168 hours in an air oven at $121^{\circ} \pm 1^{\circ} \text{C}$:

Tensile strength, minimum % of initial value	80
Elongation at rupture, minimum % of initial value	80

(c) Modulus Test. After initial conditioning period of four (4) minutes at a temperature of 150°C and at 100% elongation, the modulus must not be less than 110 pounds per square inch.

(d) Accelerated Water Absorption Characteristics.

1. Electrical Method. After twenty-four (24) hours immersion in tap water at $75^{\circ} \pm 1^{\circ} \text{C}$, the specific inductive capacity of the insulation must not be more than 7. After a continued fourteen (14) day immersion, the specific inductive capacity must not be more than three percent (3%) higher than the value determined at the end of the first day, nor more than two percent (2%) higher than the value determined at the end of the seventh day.

2. Gravimetric Method. The insulation must not absorb more than five (5) milligrams of water per square inch of exposed surface area after immersion in distilled water at 70°C for a period of seven (7) days.

- (e) Electrical Characteristics. Each completed length of insulated conductor must withstand a test voltage of 3000 volts AC for a period of five (5) minutes after immersion in water for not less than six (6) hours and while still immersed. After withstanding this dielectric test, the cable must have an insulation resistance constant of not less than 25,000.
- (f) Cold Bend Test. The cable must pass the cold bend, long-time voltage test on short specimens as outlined in ASTM D-470.
- (g) Reports Required. Test reports must include the physical properties, both initial and after aging, the accelerated water absorption characteristics, and the electrical characteristics.

PACKING

- 7. The cable must be delivered in coils containing five hundred (500) feet each. Each coil must be packed in individual dispenser cartons. Each carton must be labeled, identifying the cable type and size, manufacturer, and date of manufacture.

**ELECTRICAL SPECIFICATION 1452
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED DECEMBER 2, 2009**

POLE: ANCHOR BASE, ALUMINUM, TAPERED TUBULAR SHAFT

SUBJECT

1. This specification states the requirements for tapered, tubular, aluminum anchor base poles. They will support street light luminaires mounted on either truss type arms or davit style arms. The poles will be served by underground cables.

GENERAL

2. (a) Specifications. The poles shall conform in detail to the requirements herein stated, and to the Specifications and Methods of Test of the American Society for Testing and Materials cited by ASTM Designation Number, to the requirements of the American Welding Society, of which the most recently published revisions will govern, and to the 1994 structural standards of the American Association of State Transportation and Highway Officials.
- (b) Acceptance. Poles not conforming to this specification will not be accepted. The Commissioner will be the sole judge in determining if the poles meet this specification.
- (c) Bidders Drawings. Bidders must submit with their bids detailed scale drawings of the mast showing actual dimensions, details, and welds. Shop drawings must be original engineering drawings created by the manufacturer. The drawings must show every dimension necessary to show how all parts will fit each other and be properly held in assembly. These drawings must also be submitted in electronic format, preferably Microstation 95, if so requested by the City.
- (d) Standard Drawings. The drawings mentioned herein are drawings of the Department of Transportation being an integral part of this specification cooperating to state necessary requirements.
- (e) Sample. If requested by the Chief Procurement Officer, one completely assembled anchor-base pole of the manufacture intended to be furnished, must be submitted for review by the Commissioner within fifteen (15) business days after receipt of notice.
- (f) Warranty. The manufacturer shall warrant the performance and construction of

the light poles to meet the requirements of this specification and shall warrant all parts, components, and appurtenances against defects due to design, workmanship, or material developing within a period of three years after the light poles have been delivered. This will be interpreted particularly to mean structural or mechanical failure of any element or weld. The warranty must be furnished in writing guaranteeing material replacement including shipment, free of charge to the City. The Commissioner will be the sole judge in determining which replacements are to be made. The Commissioner's decision will be final.

STANDARDS

3. (a) Assembly. Each anchor base pole shall consist of an aluminum mast with handhole entry, aluminum hinged entry door, grounding nut, mast base plate, top cap for non-davit masts, bolt covers, and all necessary hardware required for complete assembly of these parts, ready for assembly, without special tools.
- (b) Interchangeability. Members of each pole type must be mutually interchangeable for assembly, so that no reworking will be required to make any member fit properly in the place of any other similar member of any other similar pole.
- (c) Design. Each pole type must conform in design and dimensions to the pertinent drawing(s) listed in Table "A".

MASTS

4. (a) Mast Size. The outside diameters of the mast of each pole type shall be as listed in Table A. The mast taper will be approximately 0.14 inches per foot.
- (b) Material. The shaft must be fabricated from one length of 6063-T4 wrought aluminum alloy meeting the requirements of ASTM B221. After all welding operations are completed, the mast must be brought to a T6 temper having minimum physical characteristics of ASTM B221. The wall thickness of the shaft and the diameter of the shaft shall be as listed in Table A and as shown on the appropriate standard drawing. Material certification shall be provided from the tube manufacturer.
- (c) Fabrication. The mast must be fabricated with no longitudinal or lateral welds in the tube. The completed masts must have smooth external surfaces free from protuberances, dents, cracks or other imperfections marring their appearance. Each mast must be straight and centered on its longitudinal axis.
- (d) Base. The mast base must be a permanent mold aluminum casting conforming to the requirements for aluminum alloy 356-T6 of ASTM B-108 or ASTM B-26. The base shall be similar in shape and dimensions to that shown on the appropriate standard drawing for the specific mast. The base shall consist of a collar, flange, and any other members necessary to provide strength and reduce the concentration of anticipated stresses. The shaft must extend into the base as

shown on the appropriate standard drawing and be circumferentially welded to the base casting at the top outer surface and the lower inner surface of the base. Bases must be attached to the mast so that the bearing surface of the base is at right angles to the longitudinal axis of the mast.

Non-metallic removable bolt covers which completely cover the anchor bolts and nuts must be provided. The covers must be attached with stainless steel screws or another type of non-seizing fastener, as approved by the Commissioner. The covers must enclose the anchor bolts and be secured in an approved manner.

All anchor rod openings for each pole type must have a width as listed in Table "A". Each opening must be sized to have a circumferential slot length equal to 15° of the circumference.

- (e) Cable Entry for Conventional Poles. An opening of approximately one and one quarter inches (1-1/4") in diameter, rimmed with a rubber or nylon grommet, must be furnished and installed at the point on the shaft where the clamp on the upper member of the mast arm bracket meets the pole. Certain masts may require two cable entries, depending on the order. There will be no extra compensation for the extra cable entry. This cable entry requirement does not apply to pole masts designed for davit style arms. This requirement does apply to conventional poles (Drawings 890, 938, and 939).
- (f) Option: Side Mount for Luminaire. If requested, the pole mast will be prepared for the mounting of a sidewalk-side luminaire. An opening of approximately one and one-quarter inches (1-1/4") in diameter, rimmed with a rubber or nylon grommet, must be furnished and installed at the proper height, as indicated on the appropriate standard drawing, or as directed in the order. In addition, two (2) holes must be drilled to accept two (2) rivnuts for mounting a City back plate for a mid-mount luminaire. All three (3) holes must be properly spaced and aligned to accept the City standard back plate for the appropriate mid-mount luminaire. The rivnuts (3/8-16) must be inserted in the pole. The holes must be properly aligned with the handhole.
- (g) Top of Shaft for Davit Arm. The top one foot of the mast shall be formed as shown on the appropriate standard drawing. An adapter ring may be provided if required. Two sets of holes 9/16 inches in diameter must be drilled through the mast to accommodate two bolts to attach a davit arm. The lower set (two holes) must be in line with the mast arm. The other set must be 90° apart from the other. These requirements apply to pole masts designed for davit style arms.
- (h) Provision for Ground. A tapped hole must be provided on an extension or offset, centered on the handhole door frame's interior vertical surface, to accept a 1/2"-13 bolt for a ground connection.
- (i) Entry. A vertical doorframe for reinforcing a door opening which provides access to the interior of the mast must be welded on the inside of the pole and be

centered approximately 18 inches above the bottom of the base. The doorframe must be formed and welded of aluminum alloy 6063-T6 with a cross section to adequately reinforce the opening of the mast. The doorframe must be as indicated on the appropriate standard drawing. The actual door opening must be as indicated on the appropriate standard drawing and will be sized to perfectly match the door size. The vertical centerline of the entry must be at a right angle clockwise to the vertical centerline of the mast arm. An internal flange must be welded to the inside of the pole at the bottom of the door opening. This flange will be drilled to accept a bolt. The bolt will be used to attach a hinged door to the pole. An aluminum tab must be welded to the inside upper portion of the door opening. A hole must be drilled into the tab that will accept a 1/4 inch screw. The hole must be centered horizontally in the door opening and must be centered 3/8 of an inch down from the uppermost portion of the door opening. A steel spring clip must be mounted to the tab. The clip must be made to accept a 1/4"-20 machine screw.

- (j) Door. The removable door must be formed of the same aluminum as the pole. The door must fit the pole opening within a tolerance of 1/8 of an inch. The door must be flush with the pole surface in the closed position and appear as part of the original mast. The door must be attached to an internal hinge which will allow the door to open out and down. The hinge must be bolted to a flange on the inside of the pole at the bottom of the door opening, so that the door and hinge may be un-bolted and replaced if need be. The door opening must be sized according to the appropriate standard drawing. A hole must be drilled in the top of the door in alignment with the hole on the mast. A 1/4"-20 Allen head button machine screw must be provided to fasten the door to the doorframe. The screw must have a stainless steel core with a nylon threaded body. Other types of non-seizing fasteners may be considered. All doors of the same size must be interchangeable. The door and attachment method will be subject to approval by the Commissioner or his duly authorized representative.
- (k) Tag. To each pole must be attached immediately below the handhole, by mechanical means and not by adhesive, a stainless steel tag with a stamped or embossed legend which must include the pole outside diameter at the base, the overall length, and the wall thickness.
- (l) Structural Requirements. The mast shall be manufactured in accordance with AASTHO's 1994 version of the "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals". The shaft and base assembly must be designed to meet AASTHO's 1994 criteria for 80 MPH wind loading with a 30% gust factor. The poles shall be designed appropriately for Chicago street lighting applications, including mast arm and luminaires. Thirty-foot davit poles and thirty-foot conventional poles for arterial streets must also allow for banner and flower basket attachments. The pole manufacturer must provide load calculations that verify that the poles are designed properly.

TOP CAP FOR NON-DAVIT POLES

5. The top cap shall be aluminum alloy. It must have smooth surfaces, neat edges and corners and be free from fins, holes, or other casting flaws. Three stainless steel set screws not less than 1/2 inches long must be equally spaced in tapped holes around the skirt to securely hold the top in place.

VIBRATION DAMPER

6. Each pole shaft will have an internal vibration damper, if required, located at a position as shown on the appropriate standard drawing. The vibration damper must be welded or bolted to the inside of the pole shaft. If the standard drawing does not show a vibration damper none should be provided. The design of the vibration damper is subject to approval by the Commissioner or his representative.

HARDWARE

7. All the hardware necessary to complete the assembly of the pole must be furnished. All hardware will be as specified elsewhere in these specifications. Hardware not specified elsewhere must be stainless steel, or equal corrosion-resistant non-seizing metal, or a non-metallic material subject to approval by the Commissioner.

WELDING

8. (a) General. Every welded joint shall be made in conformity with the proper interpretation of the standard welding symbols of the American Welding Society as indicated on the drawings; however, each bidder must submit with his proposal a drawing showing the sizes and types of welds, must state the type of electrode, and must describe the welding methods, he proposes to use in fabricating the pole.
- (b) Testing. All welds of five percent (5%) of the poles in every lot must be inspected for penetration and soundness of the welds by radiography, or by a penetrant method. Acceptance or rejection will be governed by the same conditions as in the TESTING Section.
- (c) Certifications. Welders must have proper certification for the welding operations required. Welding by non-certified personnel will not be allowed. Certifications must be available upon request.

FINISH

9. (a) General. All completed masts shall have a brushed satin natural finish or an anodized finish, as required by the project or in the purchase order.
- (b) A natural aluminum finish requires that each mast be rotary sand finished.

- (c) An anodized finish will be either gloss black or gloss bronze. A color sample must be submitted for approval before any factory production. The anodizing process must include cleaning, etching, anodizing, and sealing the mast. The contractor must submit his anodizing process for approval before any factory production.

MAST TEST

10. (a) General. All completed masts shall be available for testing for maximum deflection and set. The masts must meet the structural requirements of Section 4(k). Unless specifically authorized in writing, all tests must be made at the works of the manufacturer. A record of every test must be made and a certified copy of the test record must be submitted to the Engineer of Electricity before the masts are shipped.
- (b) Lot. Tests for deflection of the mast must be made upon five (5%) percent of all the masts in every lot (two (2) min.). The selection of masts for testing must be random from the entire completed lot. If any of the masts in any lot fail to meet the test, an additional three (3%) percent of the masts of the same lot must be tested (two (2) min.). If any of these masts fail to meet the test requirements, the entire lot will be subject to rejection, except that the manufacturer may subject each mast in the lot to the test, and those which fulfill the requirement will be accepted. After testing, each base weld must be inspected by radiography or the penetrant method to determine that the welds have not been affected. After testing, no permanent set should be visible or apparent. The mast should appear straight.
- (c) Mast Requirements. With base rigidly anchored, a test load of 500 pounds must be applied at a point approximately eighteen inches (18") from the free end. The load must be applied at right angles to the center line of the mast and in the same vertical plane. With no failure of any component part, the deflection must not be greater than 7.5% of the pole height. After removal of the load, the deflection measurement device must be reset to zero and the test load must be reapplied. The deflection must not change from the deflection noted in the first test by more than $\pm 5\%$.

PACKAGING

11. (a) General. The poles must be shipped in twelve (12) to twenty-five (25) pole bundles. Each pole or bundle shall not be wrapped so that the poles can receive proper air circulation to prevent water stains during outdoor storage.
- (b) Bundles. The poles in each bundle must be laid base to top to form an approximately rectangular cylinder. Materials such as lumber (2" x 4" min.), non-marring banding, and other appropriate bundling materials must be used to make a rigid, long lasting, bundle capable of being handled, shipped and stored without shifting of contents or breaking. Any bundles, in which either poles or

packaging is received broken, damaged or with contents shifted, will not be accepted and it will be the responsibility of the supplier to return the bundle to its original destination at no cost to the City of Chicago. The bundles should be capable of being stacked two (2) high without breaking, or shifting of the contents. Each bundle must be capable of being lifted by a fork lift truck or crane and the bundles must be shipped on a flat bed truck to facilitate unloading.

- (c) Hardware. The bolt covers and their attachment devices must be shipped with each bundle. The package must be labeled and placed in a prominent position to facilitate accessibility, and must be attached to, or within, the bundle in such a manner as to assure safe delivery. Payment will be withheld for any bundle delivered without the accompanying hardware. Pole caps must be attached at the manufacturer's facilities, or be packed separately in a manner similar to the bolt covers, and the same payment conditions will prevail. Cracked, broken or chipped parts will be considered as an incomplete delivery as regards payment.

- (d) Delivery. All poles will be delivered to the Division of Electrical Operations storage yard at 4101 South Cicero Avenue in Chicago, or to another location within the City as indicated on the order. Light pole information must include any recommendations of the manufacturer for storage.

TABLE A

POLE	T H I C K N E S S	BOLT CIRCLE	ANCHOR ROD	BASE P L A T E	M A X. D E F L	D R A W I N G
7"x4.5"x12'-5"	.156"	10"	1.0"	0.75"	11"	940
7"x4.5"x10'-0"	.156"	10"	1.0"	0.75"	9"	940A
7"x4.5"x20'-0"	.156"	10"	1.0"	0.75"	18"	890
8"x4.5"x29'-5"	.312"	11.5"	1.0"	1.00"	26"	942
8"x4.5"x32'-10.5"	.312"	11.5"	1.0"	1.00"	29"	939
10"x6"x24'-5"	.312"	15"	1.25"	1.25"	22"	941
10"x6"x20'-5"	.312"	15"	1.25"	1.25"	18"	941A
10"x6"x27'-10.5"	.312"	15"	1.25"	1.25"	25"	938

**ELECTRICAL SPECIFICATION 1453
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED DECEMBER 2, 2009**

MAST ARMS: ALUMINUM, TRUSS TYPE AND DAVIT TYPE

SUBJECT

1. This specification covers the requirements for aluminum mast arms for supporting street light luminaires. The aluminum arms will be supported by aluminum light poles.

GENERAL

2. (a) Specifications. The mast arms shall conform in detail to the requirements herein stated and to the Specifications and Methods of Test of the American Society for Testing and Materials cited by ASTM Designation Number, and to the requirements of the American Welding Society, of which the most recently published revisions will govern.
- (b) Acceptance. Mast arms not conforming to this specification will not be accepted. The Commissioner will be the sole judge in determining if the arms meet this specification.
- (c) Bidders Drawings. Bidders must submit with their bids detailed scale drawings of the mast arm and bracket attachment proposed to be welded to the mast arm as the means for attaching these mast arms to poles. For davit arms, drawings must show how the davit is attached to the top of the light pole and is secured. The drawings must give every dimension necessary to show how the parts will fit each other and be properly held in assembly. These drawings must also be submitted in electronic format, preferably Microstation 95, if so requested by the City.
- (d) Drawings. The drawings mentioned herein are drawings of the Department of Transportation being an integral part of this specification cooperating to state the necessary requirements.
- (e) Sample. If requested by the Chief Procurement Officer, one complete mast arm of the manufacture intended to be furnished, must be submitted within fifteen (15) business days upon receipt of such request.
- (f) Warranty. The manufacturer shall warrant the performance and construction of the mast arms to meet the requirements of this specification and shall warrant all

parts, components, and appurtenances against defects due to design, workmanship, or materials, developing within a period of three years after the mast arms have been delivered. This will be interpreted particularly to mean structural or mechanical failure of any element or weld. The warranty must be furnished in writing guaranteeing material replacement including shipment, free of charge to the City. The Commissioner will be the sole judge in determining which replacements are to be made. The Commissioner's decision will be final.

- (g) Structural Requirements. The arms shall be manufactured in accordance with AASTHO's 1994 version of the Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. The arms must be designed to meet AASTHO's 1994 criteria for 80 MPH wind loading with a 30% gust factor. The arms shall be designed for Chicago street lighting applications. The arm manufacturer must provide structural calculations that verify that the arms are designed properly.

TRUSS ARM DESIGN

3. (a) Each mast arm must be a truss type fabricated of two (2) inch "standard" aluminum pipe or tube 6063-T4 alloy conforming to the requirements of ASTM B429, or ASTM B221, or other approved design. The arm must be heat treated to a T-6 temper after fabrication and welding.
- (b) Mast Arm Attachment. The mast must be attached to the pole by means of an extruded aluminum clamp with a bolting arrangement to hold the arm firmly in place. The extrusion must be aluminum alloy 6061-T6 conforming to the requirements of ASTM B221, B308, or an approved equal. The clamps shall be designed to securely fasten the mast arm to the pole so that the arm cannot be dislodged vertically or horizontally from its intended position on the pole by wind gusts, vibrations or other normally anticipated natural phenomena.
- (c) Dimensions. The truss type arm must have the dimensions indicated on Standard Drawing 943 or Standard Drawing 944 for the appropriate arm specified. Truss arms will be available in nominal horizontal lengths of 4 foot, 6 foot, 8 foot, 12 foot, and 15 foot, with either 4.5 inch or 6 inch clamps. The distance between the lower and upper members, measured between the vertical centers of the upper and lower attachment plates, must be 1'-9". With the arm attached to the pole intended to be supplied, the vertical rise from the center of the top attachment plate to the horizontal centerline of the end of the arm must be no greater than 2'-8". The horizontal axis of the free end of the upper member, when attached to the pole, must not exceed 3° above the true horizontal without the luminaire weight, nor be less than 1/2° above the true horizontal with a 35 lb. weight supported at the free end of the arm.
- (d) Mating of Members. The upper and lower members shall be mated in such a manner as to assure that they will not separate due to vibration, weather

conditions such as high wind gusts, icing, etc., or any other normally anticipated stress condition.

- (e) Interchangeability. Members of each truss arm size must be mutually interchangeable for assembly, so that no reworking will be required to make any member fit properly in the place of any other similar member of any other similar arm.

DAVIT ARM DESIGN

- 4. (a) Each arm must be fabricated from either 4.5 inch diameter or 6.0 inch diameter aluminum tubing of 6063-T4 alloy. After all fabrication and welding, the arm must be heat treated to a T6 temper.
- (b) The arm must be attached to the mast by slipping the bottom of the arm tube over the top of the mast. The arm must have four (4) holes pre-drilled at its base to accommodate two(2) through bolts set 90° apart, as shown on the Standard Drawings. The bottom bolt will be in direct line with the length of the arm. The holes must match the holes in the mast so that after assembly the arm and mast appear as a single continuous unit. When bolted to the pole, the arm must not shift or become dislodged by wind gusts, vibrations, or other phenomena.
- (c) The davit arm must be dimensioned as indicated on Standard Drawing 945, 946, 947, 948, 949, or 950, for the appropriate arm specified. Davit arms must be available in nominal horizontal lengths of 8 foot, 12 foot, and 15 foot; for both 4.5 inch and 6 inch pole tops. Davit arms will be single or twin as specified. A 2 3/8 inch diameter tenon will be attached to the end of each arm. The horizontal axis of the tenon, when the arm is attached to the pole, must not exceed 3° above the true horizontal without the luminaire weight, nor be less than 1/2° above the true horizontal with a 35 lb. weight supported by the tenon.
- (d) Interchangeability. All davit arms for a 4.5 inch pole top must be interchangeable with each other. The same is required of davit arms for a 6 inch pole top.

WELDING

- 5. (a) General. Every welded joint shall be made in conformity with the proper interpretation of the standard welding symbols of the American Welding Society as indicated on the drawings; however, each bidder must submit with his proposal a drawing showing the sizes and types of welds, must state the type of electrode, and must describe the welding methods, he proposes to use in fabricating the arms.
- (b) Testing. All welds of five percent (5%) of the arms in every lot must be inspected for penetration and soundness of the welds by radiography or by penetrant inspection. Acceptance or rejection will be governed by the same conditions as in the TESTING Section.

- (c) Certifications. Welders must have proper certification for the welding operations required. Welding by non-certified personnel will not be allowed. Certifications must be made available upon request.

FINISH

- 6. (a) General. All completed arms shall have a brushed satin natural finish or an anodized finish, as required by the project or in the purchase order.
- (b) A natural aluminum finish requires that each arm be rotary sand finished.
- (c) An anodized finish will be either gloss black or gloss bronze. A color sample must be submitted for approval before any factory production. The anodizing process must include cleaning, etching, anodizing, and sealing the aluminum arm. The contractor must submit his anodizing process for approval before any factory production.

HARDWARE

- 7. All hardware furnished for attachment of mast arm to pole must be series 300 stainless steel. All hardware necessary to complete the assembly of the arm to the pole must be provided.

MAST ARM TESTS

- 8. (a) General. Five percent (5%) of the mast arms of each size in every order shall be tested for structural integrity.
- (b) Tests. The mast arms, when securely attached to a suitable and proper supporting structure, must withstand a horizontal (sideward) pulling force as indicated in Table A, and a vertical (downward) load as indicated in Table A. These loads may be applied independently. Each load must be applied at the end of the arm without any apparent permanent set, or damage to the welds joining the arm and mast arm attachment. The appropriate loading for each arm is indicated in Table A. On twin arms each arm extension must be tested.
- (c) Rejection. If the mast arms fail to meet the test, an additional three percent (3%) of the mast arms in the same lot must be tested. If any of these mast arms fail to meet the test requirements, the entire lot will be subject to rejection, except that the manufacturer may subject each mast arm in the lot to the test, and those which fulfill the requirements will be accepted.
- (d) All tests shall be certified by the manufacturer. Test documentation shall be made available to the City upon request.

PACKAGING

9. (a) General. The mast arms shall be shipped in fifty (50) to seventy five (75) mast arm bundles without any wrapping on the individual arms or the entire bundle. All wrapping is to be omitted to assure proper air circulation over and between the arms to prevent water stains during outdoor storage.
- (b) Bundles. The bundles shall consist of fifty (50) to seventy five (75) arms laid to form an approximately rectangular bundle. Materials such as lumber (2"x4"), stainless steel banding, and other appropriate bundling materials must be used to make a rigid, long lasting, bundle capable of being handled, shipped and stored without shifting of contents or breaking, subject to approval. Any bundles received broken, damaged, or with contents shifted, either the arms or the packaging, will not be accepted, and it will be the responsibility of the supplier to return the bundle to its original destination at no cost to the City of Chicago. The bundles should be capable of being stacked two (2) high without breaking, or shifting of the contents. Each bundle must be capable of being lifted by a fork lift truck or crane and the bundles must be shipped on a flat bed truck to facilitate unloading.
- (c) Hardware. The clamp backs and mounting hardware must be attached to the clamp fronts on the end of the arm, and must be shipped with each mast arm bundle. Mounting hardware for the davit arms must be packed and shipped with each davit arm bundle. Payment will be withheld for any bundle delivered without the accompanying hardware. Cracked, broken or chipped parts will be considered as an incomplete delivery as regards payment.

TABLE A

ALUMINUM ARM	HORIZONTAL LOAD	VERTICAL LOAD	DRAWING #
Truss 4.5"x 4'	100#	250#	943
Truss 4.5"x 6'	100#	250#	943
Truss 4.5"x 8'	100#	250#	943
Truss 4.5"x 12'	100#	250#	943
Truss 4.5"x 15'	100#	250#	943
Truss 6.0"x 4'	100#	250#	944
Truss 6.0"x 6'	100#	250#	944
Truss 6.0"x 8'	100#	250#	944
Truss 6.0"x 12'	100#	250#	944
Truss 6.0"x 15'	100#	250#	944
Davit 4.5"x 8'	100#	250#	945
Davit 4.5"x 12'	100#	200#	946
Davit 4.5"x 15'	100#	200#	947
Davit 6.0"x 8'	100#	250#	948
Davit 6.0"x 12'	100#	250#	949
Davit 6.0"x 15'	100#	250#	950

**ELECTRICAL SPECIFICATION 1458
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED JULY 10, 2006**

**ELECTRICAL MANHOLE FRAMES AND COVERS
24 INCH AND 30 INCH DIAMETER**

SCOPE

1. This specification describes the requirements for both 24 inch and 30 inch round frames and covers. These frames and covers will be used for electrical manholes and handholes and will provide access to the interior of the manholes and handholes. The 24 inch frames and covers will be used in parkway and sidewalk areas. The 30 inch frames and covers will be used in streets and in driveways and will provide sufficient strength to withstand normal traffic conditions.

GENERAL REQUIREMENTS

2. (a) Conformance. The manhole frames and covers shall conform with every detail of the requirements herein stated and to the specifications and methods of test of the American Society for Testing and Materials cited by ASTM Designation Number in which the most recently published revision will govern.
- (b) Acceptance. Frames and covers not conforming to this specification will not be accepted. The Commissioner of Transportation will have the final say as to whether or not the frames and covers meet specifications.
- (c) Drawings. The drawings mentioned herein are drawings of the Department of Transportation, Division of Engineering, and must be interpreted as part of these specifications.
- (d) Sample. Upon request, one complete manhole frame and cover of the manufacture intended to be furnished must be submitted within fifteen (15) business days after receipt of such a request from the Chief Procurement Officer. The samples must be delivered to the Division of Electrical Operations, 4101 South Cicero Avenue, Chicago, Illinois.
- (e) Warranty. The manufacturer shall warrant that the frames and covers meet the specifications and warrant the frames and covers for a period of one (1) year from the date of delivery against defects which may occur during that period from normal and customary use. Any frame or cover which fails during this period must be replaced by the manufacturer at no cost to the City.

DESIGN

3. (a) The frames and covers shall each conform in detail to the designs shown on Drawings 872, 874 and 10927.
- (b) Each frame and cover shall weigh approximately as shown on the drawings.
- (c) Machining. The bearing surfaces of both the cover and the frame shall be machine finished as indicated on the drawings.
- (d) Workmanship. The frames and covers must be mutually interchangeable size for size, so that each lid will fit every frame neatly without jamming and with only such clearance as the drawings indicate. In addition, 24" & 30" covers must fit existing 24" & 30" frames, as shown on drawings 872, 874 and 10927. The castings shall be neat, true to pattern and free from cracks and casting flaws. No welding of defective castings will be permitted nor must the castings be painted.
- (e) Material. The frames and covers must be made of Class 30 Cast Iron described in the specifications for Gray Iron Castings of ASTM A48. No plugging of defective castings will be permitted.

TESTS

4. (a) Test bars of the metal used for the castings shall be made and tested for tensile and transverse strength in accordance with ASTM A48. The metal must be tested at the works of the manufacturer. The manufacturer must furnish a certified copy of all test data sheets to the City prior to delivery of the castings. Frames and covers shall each be considered a separate casting for determining the requirement of testing.

**ELECTRICAL SPECIFICATION 1462
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED AUGUST 3, 2006**

**RIGID STEEL CONDUIT
(HOT DIPPED GALVANIZED)**

SCOPE

1. This specification describes rigid steel conduit, zinc coated. This specification also describes rigid steel conduit that is both zinc and PVC coated. The conduit will be used underground or on structure as a raceway for electrical cables.

GENERAL REQUIREMENTS

2.
 - (a) Rigid steel conduit must be zinc coated by the hot-dip process. Conduit must be furnished in 10 foot lengths, threaded on each end and with one coupling attached to one end and a protective cap at the other end.
 - (b) The conduit shall be manufactured according to Underwriters Laboratories Standard U.L. - 6 and must meet ANSI Standard C 80.1 and the requirements of NEC Article 344. In addition, conduit must be recognized as an equipment grounding conductor as per NEC Article 250.118(2). There will be no exceptions to meeting these standards.
 - (c) Acceptance. Conduit not conforming to this specification will be rejected. The Commissioner will be the final judge in determining if the conduit meets the specification.
 - (d) Sample. If requested by the Chief Procurement Officer, a sample of conduit must be submitted to the Engineer of Electricity within fifteen (15) business days of receipt of such a request.
 - (e) Warranty. The manufacturer shall warrant the construction and performance of the conduit to meet the requirements of this specification and shall warrant all parts and components against defects due to design, workmanship, or material developing within a period of one (1) year after the conduit has been delivered.

STEEL

3. (a) Conduit shall be formed from steel suitable for use as an electrical raceway. It shall be structurally sound so that it will hang straight and true when supported by hangers in accordance with Chicago electrical code requirements and shall be capable of being field bent without deformation of the walls.
- (b) Conduit shall have a circular cross section sufficiently accurate to permit the cutting of threads in accordance with Table 2 and shall provide a uniform wall thickness throughout. All surfaces shall be smooth and free of injurious defects. The dimensions and weights of rigid steel conduit must be in accordance with Table 1.

THREADING AND CHAMFERING

4. (a) Each length of conduit, and each nipple, elbow and bend must be threaded on both ends, and each end must be chamfered to remove burrs and sharp edges.
- (b) The number of threads per inch, and the length of the threaded portion at each end of each length of conduit, nipple and elbow must be as indicated in Table 2. The perfect thread must be tapered for its entire length, and the taper must be 3/4 inch per foot.

ZINC COATING

5. (a) After all cutting, threading, and chamfering all conduit surfaces shall be thoroughly cleaned before application of zinc. The cleaning process shall leave the interior and exterior surfaces of the conduit in such a condition that the zinc will be firmly adherent and smooth.
- (b) The conduit must be hot dipped galvanized both inside and out to provide approximately two (2) ounces of zinc per square foot. This is equivalent to 3.4 mils of zinc coating. An additional interior coating to aid in the installation of wires is required.

COUPLINGS

6. (a) The outside surface of couplings shall be protected by means of a zinc coating. The zinc content of the coating on the outside surface must be equivalent to a minimum thickness of 3.4 mils.
- (b) Couplings shall be so made that all threads will be covered when the coupling is pulled tight on standard conduit threads.
- (c) Both ends of the coupling must be chamfered to prevent damage to the starting threads.

- (d) The outside diameter, length and weight of coupling must be as indicated in Table 3.
- (e) Couplings must be straight tapped, except that the 2 1/2 inch and larger sizes may be taper-tapped.

PVC COATED (WHEN SPECIFIED)

- 7. (a) Only hot dipped galvanized conduit, couplings, and fittings may be polyvinylchloride (PVC) coated.
- (b) All conduit, couplings, and fittings must be cleaned before being coated.
- (c) All conduit, couplings, and fittings must have a PVC coating applied to the exterior by dipping in liquid plastisol. The coating thickness must be a nominal 40 mils.
- (d) All coated conduit, couplings, and fittings must conform to the requirements of NEMA Standard RN1- Section 3, "External Coatings". The latest revision will apply.

PACKING AND IDENTIFICATION

- 8. (a) The pipe shall be delivered in bundles. Each length of conduit must be marked with the manufacturer's name or trademark. Securely attached to each bundle at two (2) locations on the bundle must be a weather resistant tag containing the following information:
 - (a) conduit size
 - (b) footage of bundle
 - (c) gross weight of bundle
- (b) Precaution will be taken by the contractor in handling during shipment or delivery of conduit, and any conduit found to be damaged will not be accepted.

TEST AND INSPECTION

- 9. (a) Galvanized rigid conduit must be capable of being bent cold into a quarter of a circle around a mandrel, the radius of which is four times the nominal size of the conduit, without developing cracks at any portion and without opening the weld.
- (b) The protective coatings used on the outside and inside surfaces of rigid steel conduit must be sufficiently elastic to prevent their cracking or flaking off when a finished sample of 2 inch conduit is tested within one year after the time of manufacture, by bending it into a half of a circle around a mandrel, the radius of which is 3 1/2 inches.

- (c) Tests on sizes other than 1/2 inch may be conducted within one year after the time of manufacture. If such tests are conducted, the conduit must be bent into a quarter of a circle around a mandrel, the radius of which is six times the nominal size of the conduit.
- (d) One of the following three test methods shall be employed for measuring the thickness or extent of the external zinc coating on conduit:
 - (a) Magnetic test.
 - (b) Dropping test.
 - (c) Preece test (Material which will withstand four 1-minute immersions will be considered as meeting requirements as follows; the zinc content of the coating on the outside surface must be equivalent to a minimum thickness of 3.4 mils).
- (e) All tests and inspections must be made at the place of manufacture prior to shipment unless otherwise specified, and shall be so conducted as not to interfere with normal manufacturing processes.
- (f) Each length of conduit shall be examined visually both on the outside and inside to determine if the product is free from slivers, burrs, scale or other similar injurious defects (or a combination thereof), and if coverage of the coating is complete.
- (g) If any samples of rigid steel conduit tested as prescribed in this specification should fail, two additional samples must be tested, both of which must comply with the requirements of the specification.
- (h) All pipe which may develop any defect under tests, or which may before testing or on delivery be found defective, or not in accordance with these specifications, must be removed by the Contractor at his own expense; and such pipe so removed by the Contractor must be replaced by him within ten (10) days of such rejection with other pipe which will conform to these specifications.

TABLE 1

Design Dimension and Weights of Rigid Steel Conduit

Nominal or Size of Conduit	Inside Diameter	Outside Diameter	Wall Thickness	Length Without Coupling	Minimum Weight Trade of Ten Unit Length w/couplings
(Inches)	(Inches)	(Inches)	(Inches)	(Feet/Inches)	(Pounds)
1/2	0.622	0.840	0.109	9-11 1/4	79.00
3/4	0.824	1.050	0.113	9-11 1/4	105.0
1	1.049	1.315	0.133	9-11	153.0
1 1/4	1.380	1.660	0.140	9-11	201.0
1 1/2	1.610	1.900	0.145	9-11	249.0
2	2.067	2.375	0.154	9-11	334.0
2 1/2	2.469	2.875	0.203	9-10 1/2	527.0
3	3.068	3.500	0.216	9-10 1/2	690.0
3 1/2	3.548	4.000	0.226	9-10 1/4	831.0
4	4.026	4.500	0.237	9-10 1/4	982.0

NOTE: The applicable tolerances are:

Length: + 1/4 inch (without coupling)

Outside diameter: + 1/64 inch or -1/32 inch for the 1 1/2 inch and smaller sizes,
 ± 1 % for the 2 inch and larger sizes.

Wall thickness: - 12 1/2 %

TABLE 2

Dimensions of Threads

Nominal or Trade Size of Conduit (Inches)	Threads per Inch	Pitch Diameter at end of Thread (Inches) Tapered 3/4 Inch per foot	Length of Thread (Inches)	
			Effective L2	Overall L4
1/2	14	0.7584	0.53	0.78
3/4	14	0.9677	0.55	0.79
1	11 1/2	1.2136	0.68	0.98
1 1/4	11 1/2	1.5571	0.71	1.01
1 1/2	11 1/2	1.7961	0.72	1.03
2	11 1/2	2.2690	0.76	1.06
2 1/2	8	2.7195	1.14	1.57
3	8	3.3406	1.20	1.63
3 1/2	8	3.8375	1.25	1.68
4	8	4.3344	1.30	1.73

NOTE: The applicable tolerances are:

Threaded Length (L4 Col 5): Plus or minus one thread

Pitch Diameter (Col 3): Plus or minus one turn is the maximum variation permitted from the gaging face of the working thread gages. This is equivalent to plus or minus one and one half turns from basic dimensions, since a variation of plus or minus one half turn from basic dimensions is permitted in working gages.

TABLE 3

Designed Dimensions and Weights of Couplings

Nominal or Trade Size of Conduit <u>(INCHES)</u>	Outside Diameter <u>(INCHES)</u>	Minimum Length <u>(INCHES)</u>	Minimum Weight <u>(POUNDS)</u>
1/2	1.010	1-9/16	0.115
3/4	1.250	1-5/8	0.170
1	1.525	2	0.300
1 1/4	1.869	2-1/16	0.370
1 1/2	2.155	2-1/16	0.515
2	2.650	2 1/8	0.671
2 1/2	3.250	3-1/8	1.675
3	3.870	3-1/4	2.085
3 1/2	4.500	3-3/8	2.400
4	4.875	3-1/2	2.839

**ELECTRICAL SPECIFICATION 1465
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED JULY 12, 2006**

GROUND RODS

SUBJECT

1. This specification states requirements for ground rods and clamps to be used for ground electrodes in street lighting, traffic signal, and miscellaneous electrical circuits.

GENERAL

2. (a) Ground rods must be copper clad, steel rods suitable for driving into the ground without deformation of the rod or scoring, separation or other deterioration of the copper cladding.
- (b) Sample. If requested by the Chief Procurement Officer, the contractor must furnish one sample of the ground rod proposed to be furnished within fifteen (15) business days from receipt of such request. The sample ground rod must be delivered to the Division of Electrical Operations, 2451 S. Ashland Avenue, Chicago, Illinois 60608.
- (c) Warranty. The manufacturer shall warrant every ground rod against defects due to design, workmanship, or material developing within a period of one (1) year after the ground rod has been accepted. Any ground rod which fails during this period must be replaced by the contractor without expense to the City. The Commissioner of Transportation or his duly authorized representative will be the sole judge in determining which replacements are to be made.
- (d) The Commissioner will be the sole judge in determining whether the submitted ground rods meet the requirements of this specification. Ground rods not accepted must be removed at the sole expense of the contractor.

DESIGN

3. (a) The ground rods and couplings must meet the latest requirements of (National Electrical Manufacturer's Association) NEMA Standard GR-1, for copper bonded ground rod electrodes and couplings. The ground rods must also meet the requirements of (Underwriter's Laboratories) UL 467.

- (b) Ground rods shall be made of steel core suitable for driving into the earth without deformation.
- (c) A uniform covering of electrolytic copper, 10 mils in thickness, shall be metallurgically bonded to the steel core to provide a corrosion resistant, inseparable bond between the steel core and the copper overlay.
- (d) The finished rod must be of uniform cross-section; straight, and free of nicks, cuts or protuberances.
- (e) The rod must be pointed at one end and chamfered at the other.
- (f) All ground rods must be three-quarter inches (3/4") in diameter. The length shall be as specified in the order or in the plans. The length and diameter of the rod and the manufacturer must be clearly and permanently marked near the top of the rod (chamfered end).
- (g) All ground rods must have a ground clamp capable of accommodating a No. 6 AWG Copper Wire.

PACKING

- 4. (a) Ground rods must be packed in bundles with reinforced tape or plastic banding that will not damage the rods. Small bundles may then be bound in larger bundles held together with steel banding.
- (b) Ground clamps must be packed in a suitable carton. The carton must be labeled to indicate the contents.

ELECTRICAL SPECIFICATION 1467

**DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
MAY 12, 1993**

ROD: ANCHOR, STEEL, WITH HARDWARE

SUBJECT

1. This specification states the requirements for steel anchor rods with hardware for street light pole foundations.

GENERAL

2. (a) Specifications. The anchor rods shall conform in detail to the requirements herein stated, and to the specifications of the American Society for Testing and Materials cited by ASTM Designation Number, of which the most recently published revision will govern.
- (b) Drawing. The drawings mentioned herein are issued by the Department of Transportation, Division of Engineering, and are an integral part of this specification.

ANCHOR ROD

3. (a) Fabrication. Each anchor rod must be fabricated in conformity with City of Chicago drawings numbered 806, 811, 830 and 844.
- (b) Material. The rods must be fabricated from cold rolled carbon steel bar meeting the requirements of ASTM Specification A-36, except that the Specification must be modified to provide a minimum yield point of 55,000 psi (379 MPa).
- (c) Thread. The straight end of each rod must be threaded as shown on City of Chicago drawing for that size rod, and must be American Standard, National Coarse.

HARDWARE

4. Hardware furnished with the anchor rod shall be as shown on the applicable drawing. It must include two (2) hexagonal nuts, American Standard Regular, two (2) flat washers, type B, series W, and one (1) lock washer, steel, helical spring. The nuts must have a Class 2 or 3 fit.

FINISH

5. (a) Galvanizing. The threaded end of each rod must be hot dipped galvanized for the distance shown on the applicable drawing. The thickness of the galvanized coating must not be less than 0.0021 inches. Each hexagonal nut and washer must be galvanized to the minimum thickness required by ASTM A-153, Class C, or ASTM B-454, Class 50. After galvanization, each anchor rod and nut must have a mating fit equivalent to the American Standard Class 2 or 3 fit for nuts and bolts.
- (b) Rust Inhibitor. With the hardware in place on the end of the bolt, the galvanized portion of the bolt must be coated with heavy No-Ox-Id or equal rust inhibiting greasy compound.

TESTS

6. At the discretion of the Commissioner, anchor rods and hardware furnished under this specification will be subject to testing to determine compliance with the materials physical requirements.

INSPECTION

7. Final inspection must be made at point of delivery. Any anchor rods and hardware rejected must be removed by the Contractor at his sole expense.

ELECTRICAL SPECIFICATION 1524

**DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED JULY 31, 2006**

LAMPS: HIGH PRESSURE SODIUM FOR STREET LIGHTING

SUBJECT

1. This specification states the requirements for high pressure sodium lamps for street lighting service. Lamps must burn in various positions: base up, base down, and horizontal.

PHYSICAL REQUIREMENTS

2. The lamps must conform to the physical characteristics of ANSI Standard C78.42-1995 "High-Pressure Sodium Lamps". All bases must be of the screw-shell-type made of brass and meeting ANSI Standard C81.61. Bases will be mogul or medium depending upon the requirements. Bulb material must be lead borosilicate glass. The bulb finish must be clear. The arc tube material must be polycrystalline aluminum oxide.

ELECTRICAL REQUIREMENTS

3. The lamp must conform to the electrical characteristics of ANSI Standard C78.42-1995.

LIGHT OUTPUT

4. The color temperature of the lamp must be between 1050 and 2100 degrees Kelvin. At half the average rated lamp life, the mean output lumens must not be less than 90% of the initial lumen output.

TESTING

5. All lamps must be tested according to the requirements in ANSI Standard C78.42-1995. Because street light lamps operate under harsher conditions than most lamps, the physical structure of these lamps will be required to withstand the vibrations due to weather and traffic conditions expected in the Chicago area.

INDIVIDUAL LAMP CHARACTERISTICS

6. High pressure sodium lamps must meet the following:

Wattage	Rated Life (hours)	Initial Lumens	Lamp Voltage
35	16000	2250	52
50	24000	4000	52
70	24000	5800	52
100	24000	9500	55
150	24000	15000	100
200	24000	22000	100
250	24000	27500	100
310	24000	37000	100
400	24000	50000	100
750	16000	110000	120
1000	24000	140000	250

WARRANTY

7. (a) The manufacturer will be required to replace, with new rated life lamps, without cost to the City, all lamps failing to operate satisfactorily for the specified period as indicated in the following paragraphs.
- (b) Any lamp that fails during the first 500 hours of operation must be replaced with a new, operable, lamp without charge to the City.
- (c) After the first 500 hours of operation, based on published lamp mortality tables, any lamp failures in excess of the published figures will require replacement lamps in numbers equal to the excess failures. This will apply for the first three years of the lamp life. All replacements will be at no cost to the City. Replacement lamps must be new.

PACKAGING

8. (a) All lamps must have the date of manufacture, either actual or coded, embossed on the lamp base or another suitable location.
- (a) All lamps must be individually packaged and packed in properly labeled cartons so as to prevent damage in shipping or storage.

**ELECTRICAL SPECIFICATION 1528
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
REVISED MAY 1, 2004**

PRECAST CONCRETE STRUCTURES

SUBJECT

1. This specification covers the requirements for precast concrete structures to be used as City of Chicago electrical facilities. The structures will include manholes, handholes, and street light pole foundations.

GENERAL

2. (a) Specifications. The precast structures must conform in detail to the requirements herein stated and to the Specifications and Methods of test of the American Society for Testing and Materials cited by ASTM Designation Number of which the most recently published revision will govern.
- (b) Acceptance. Precast structures not conforming to this specification will not be accepted. The Commissioner of Transportation or his representative will be the sole judge in determining if the precast structures meet this specification. The Commissioner's decision will be final.
- (c) Drawings. The drawings mentioned herein are drawings of the Department of Transportation. They are integral parts of this specification cooperating to state necessary requirements.
- (d) Bidders Drawings. Bidders must submit with their bids detailed scale drawings of the precast structures showing actual dimensions and details. Shop drawings must be original engineering drawings created by the manufacturer. The drawings must give every dimension necessary and show how the structure is assembled.
- (e) Sample. One complete precast structure of each item must be submitted within fifteen (15) business days upon request of the Chief Procurement Officer.
- (f) Warranty. The manufacturer must warrant the performance and construction of the precast structures to meet the requirements of this specification and must warrant all parts, components, and appurtenances against defects due to design, workmanship, or material developing within a period of one (1) year after the precast structures have been delivered. This will be interpreted particularly to mean structural failure of any element. The warranty must be furnished in writing

guaranteeing material replacement including shipment, free of charge to the City. The Commissioner will be the sole judge in determining which replacements are to be made. The Commissioner's decision will be final.

DESIGN

3. (a) **Material.** Concrete must be Portland cement concrete, Class SI or PC, meeting current IDOT specifications. Pulling irons in manholes must meet or exceed the requirements of ASTM A36 steel. Pulling irons must be hot dipped galvanized. Steel reinforcing bars must meet or exceed the requirements of ASTM A615, Grade 60. Cable supports in manholes, including stanchions and racks, must be manufactured for that specific purpose. Stanchions must be non-metallic and must be capable of accommodating several different sizes of cable hooks at various elevations. A minimum of eight cable hooks, 4 inches in length, must be provided with each manhole, and should include any hardware necessary to affix the hooks to the racks. Cable hooks for handholes must be manufactured for that specific purpose. Cable hooks for handholes must be a minimum of 3 inches in length and 3 inches in depth. Anchor rods in foundations must meet the latest Electrical Material Specification 1467. Conduit elbows in foundations must meet the latest Electrical Material Specification 1462.

Foundations must include conduit elbows, anchor rods, washers, and nuts. Handholes must include cable hooks. Manholes must include cable racks, pulling irons, and cable hooks. Frames and covers, sump grates, clay tile, and ground rods are not included under this specification.

- (b) **Dimensions.** Each manhole, handhole, and foundation must be dimensioned as shown on the appropriate standard drawing. The 30 inch diameter handhole is Standard Drawing 867. The 36 inch diameter handhole for 24 inch frame and cover is Standard Drawing 866. The 36 inch diameter for 30 inch for frame and cover is Standard Drawing 871. The 3 foot by 4 foot by 4 foot manhole for a 24 inch diameter frame and cover is Standard Drawing 730. The 3 foot by 4 foot by 4 foot manhole for 30 inch frame and cover is Standard Drawing 729. The 4 foot by 6 foot by 6 foot manhole for 24 inch frame and cover is Standard Drawing 732. The four foot by 6 foot by 6 foot manhole for 30 inch frame and cover is Standard Drawing 733. The 5 foot 4 inch by 7 foot 4 inch manhole roof is Standard Drawing 733. The precast 5 foot foundation is Standard Drawing 565.
- (c) **Construction.** Each manhole and each handhole must have lifting anchors cast in the concrete to facilitate shipment and installation. If the manhole or handhole is in more than one piece, instructions for assembly must be provided. Also, a sufficient amount of bonding agent must be provided. The bonding agent must be approved material.

DELIVERY

4. All manholes, handholes, and foundations will be delivered to the Division of

Electrical Operations storage yard at 4101 South Cicero Avenue in Chicago, or to another location within the City as indicated on the order. Any manhole, handhole, or foundation deemed to be defective by the Commissioner or his representative must be removed and replaced at no cost to the City. The Commissioner's decision will be final.

ELECTRICAL SPECIFICATION 1533

**DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
AUGUST 8, 2006**

NON-METALLIC CONDUIT

SCOPE

1. This specification states the requirements for both rigid and coilable non-metallic conduit. The conduit will be used for low voltage (600 volt rated cables) electrical street lighting and traffic control systems. It may also be used for fiber-optic communications cables. This conduit will be installed underground. Rigid non-metallic conduit may be installed on structure.

GENERAL

2. (a) Standards. The following standards are referenced herein.

ASTM – American Society for Testing and Materials
NEC – National Electrical Code
NEMA – National Electrical Manufacturer’s Association
UL – Underwriter’s Laboratories
- (b) Warranty. The manufacturer must warrant the conduit against defective workmanship and material for a period of one year from date of installation or date of delivery. Any conduit that is found to be defective must be replaced without cost to the City.
- (c) Sample. If requested by the Chief Procurement Officer, a sample of the conduit intended to be furnished under this specification, must be submitted to the Engineer of Electricity within fifteen (15) business days upon receipt of such request.

MATERIAL

2. (a) Rigid non-metallic conduit will be made of polyvinyl chloride (PVC). All conduit and fittings must comply with ASTM D 1784 and with the applicable sections of NEMA TC2, UL standard 651, and NEC Article 347. Fittings must meet the standards of NEMA TC3 and TC6, as well as UL 514.
- (b) Coilable non-metallic conduit will be made of high density polyethylene (HDPE). All conduit must comply with ASTM D3485, ASTM D 1248, and NEMA TC7.

SIZES

3. (a) PVC and HDPE will come in two wall thicknesses; schedule 40 and schedule 80.
- (b) PVC will come in ten foot sections. HDPE will come on reels.
- (c) Nominal inside diameters (in inches) for non-metallic conduits will include the following: $\frac{1}{2}$, $\frac{3}{4}$, 1, 1 $\frac{1}{4}$, 1 $\frac{1}{2}$, 2, 2 $\frac{1}{2}$, 3, 3 $\frac{1}{2}$, 4.

PACKING

4. Rigid conduit must be shipped in bundles. Coilable conduit must come on wooden reels. Both bundles and reels must be tagged to indicate the size and diameter of the conduit, the quantity in feet, the weight, and the manufacturer's name. The conduit itself must be marked to indicate the type and size, as well as the manufacturer.

**ELECTRICAL SPECIFICATION 1534
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
SEPTEMBER 25, 2006**

CABLE: SINGLE-CONDUCTOR, COPPER 600 VOLT

SUBJECT

1. This specification states the requirements for cables intended to be used as conductors in 120/240 VAC, 60 cycle, single phase, street lighting circuits. The cables will be installed in underground ducts or conduit.

GENERAL

2. (a) Specifications. The cable must conform in detail to the requirements herein stated, and to the applicable portions of the latest revisions of the specifications and methods of test of the following agencies:
 - (1) ICEA Specification S-95-658
 - (2) IEEE Standard 383
 - (3) ASTM Standard E662-06
 - (4) ASTM Standard D470-05
 - (5) U.L. 44
 - (6) U.L. 854
- (b) Acceptance. Cable not in accordance with this specification will not be accepted.
- (c) Sample. If requested by the Chief Procurement Officer, a three (3) foot sample of the cable intended to be provided under this specification must be sent to the attention of the Engineer of Electricity within fifteen (15) days of receipt of such request.
- (d) Warranty. The manufacturer must warrant the cable to be first class material throughout. In lieu of other claims against them, if the cables are installed within twelve (12) months of date of shipment, the manufacturer must replace any cable failing during normal and proper use within two years of date of installation. All replacements under this warranty must be made free of charge F.O.B. delivery point of the original contract.

CONSTRUCTION

3. This cable must consist of a round copper conductor with a tight fitting, free

stripping, concentric layer of ethylene propylene (EPR) insulation and a concentric low lead chlorosulfonated polyethylene (CSPE) jacket extruded in tandem with, and bonded to, the insulation, or ethylene propylene (EPR) insulation only. The cable must be rated for continuous duty in wet or dry conditions at 90° C operating temperature, 130° C emergency overload temperature and 250° C short circuit temperature.

CONDUCTOR

- 4. (a) Material. The conductor must either be soft or annealed round copper wire.
- (b) Specifications. The conductor must meet the requirements of ASTM B3, B8 or B258, as applicable.
- (c) Sizes. The conductor size must be as stated in the PROPOSAL and in accordance with all requirements in Table A of this specification.
- (d) Stranding. The number of strands, must be as indicted in Table A. Stranding must meet the requirements of ASTM B8, Class B.

INSULATION

- 5. (a) Type. The insulation must be ethylene propylene rubber compound meeting the physical and electrical requirements specified herein.
- (b) Thickness. The insulation must be circular in cross-section, concentric to the conductor, and must have an average thickness not less than that set forth in Table A of this specification, and a spot thickness not less than ninety percent (90%) of the average thickness.
- (c) Initial Physical Requirements:
 - 1. Tensile strength, min., psi. 1,200
 - 2. Elongation at rupture, min. % 250
- (d) Air Oven Exposure Test. After conditioning in an air oven at 121 +/- 1°C for 168 hours using methods of test described in ASTM-D 573:

Tensile strength, minimum percent of unaged value.....75

Elongation at rupture, minimum percent of unaged value.....75
- (e) Mechanical Water Absorption:

GRAVIMETRIC METHOD: After 168 hours in water at 70+/- 1°C:
water absorption, maximum, milligrams per square inch.....5

- (f) Cold Bend Test Requirements. The completed cable must pass the "Cold-Bend, Long-Time Voltage Test on Short Specimens" of ASTM D-470 except that the test temperature must be minus (-) 25°C.
- (g) Electrical Requirements
 - 1. Voltage Test. The completed cable must meet an A.C. and D.C. voltage test in accordance with ASTM D-470 and D-2655.
 - 2. Insulation Resistance. The completed cable must have an insulation resistance constant of not less than 20,000 when tested in accordance with methods shown in ASTM D-470.

JACKET

- 6. (a) Type. If the cable is jacketed, the jacket must be a chlorosulfonated polyethylene (CSPE) compound meeting the physical and electrical requirements specified herein. The CSPE jacket must meet CFR Title 40, Part 261, for leachable lead.
- (b) Thickness. The jacket must be circular in cross-section, concentric with the insulation, must have an average thickness not less than that set forth in Table A of this specification and a spot thickness not less than ninety percent (90%) of the average thickness.
- (c) Initial Physical Requirements:
 - 1. Tensile strength minimum PSI 1800
 - 2. Elongation at rupture, minimum percent 300
- (d) Air Oven Exposure Test. After conditioning in an air oven at 121 +/- 1°C for 168 hours:
 - 1. Tensile strength, minimum percent of unaged value 75
 - 2. Elongation at rupture, minimum percent of unaged value 60
- (e) Mechanical Water Absorption. After 168 hours at 70 +/- 1°C:
 - 1. Milligrams per square inch, maximum 20

TESTING

- 7. (a) General. Tests must be performed on insulation, jacket and completed cables in accordance with applicable standards as listed in these specifications.

Where standards are at variance with each other or with other portions of this specification, the most stringent requirements, as determined by an engineer from the City, will apply. All tests must be conducted on cable produced for this order. Where cable insulation and/or jacket thickness preclude obtaining samples of sufficient size for testing, special arrangements must be made with the engineer to obtain samples of unprocessed materials directly from the extrusion feed bins which will be separately processed and prepared for tests.

- (b) Number Of Tests. Insulation and jacket tests must be conducted on samples taken every 25,000 feet or fraction thereof of each conductor size. In no case must samples be taken closer than 15,000 feet apart.
- (c) Flame Tests. Included in the tests will be a 70,000 BTU per hour flame test in accordance with IEEE 383. Reels to be tested will be selected at random.
- (d) Test Reports. No cable may be shipped until certified copies of all factory tests have been reviewed and approved by the engineer.
- (e) Acceptance. Samples must be taken from each reel and must successfully conform to all tests specified herein. Reels from which samples fail to conform, will be rejected.

PACKAGING

- 8. (a) Cable Marking. The cable must be identified by a permanently inscribed legend in white lettering as follows:

1/c No. (conductor size) AWG-600V-90°C-EPR or EPR/CSPE

The legend must be repeated at approximately eighteen (18) inch intervals on the outside surface of the cable parallel to the longitudinal axis of the conductor. A sequential footage marking must be located on the opposite side from the legend.

- (b) All cable will be black pigmented. When three conductors (triplex) are specified, one conductor will be black, another will be red or black with a red tracer, the smaller of the conductors must have a green colored jacket and the three conductors must be triplexed with a 16"-18" lay. The insulation color must not be unduly affected by cable installation, or prolonged exposure to either direct sunlight or moisture.
- (c) Reels. The completed cable must be delivered on sound substantial, non-returnable reels. Both ends of each length of cable must be properly sealed against the entrance of moisture and other foreign matter by the use of clamp-on cable caps, such as the Reliable Electric Company neoprene cable cap No. 1405, or equal. The ends must be securely fastened so as not to become loose in transit. Before shipment, all reels must be wrapped with cardboard or other approved wrapping.

- (d) Footage. Each reel must contain the length of cable as set forth in Table A of this specification. Alternate lengths may be considered.

- (d) Reel Marking. A metal tag must be securely attached to each reel indicating the reel number, contract number, date of shipment, gross and tare weights, description of the cable, the total footage, and the beginning and ending sequential footage numbers. Directions for unrolling the cable must be placed on the reel with an approved permanent marking material such as oil-based paint or a securely attached metal tag.

TABLE "A"

CONDUCTOR		INSULATION/JACKET THICKNESS		A-C TEST	REEL LENGTH
<u>AWG</u>	<u>STRANDS</u>	<u>MILS</u>	<u>MILS</u>	<u>VOLTS</u>	<u>FEET</u>
14	7	30	15	5500	2000
8	7	45	15	5500	2000
6	7	45	30	5500	2000
4	7	45	30	5500	2000
2	7	45	30	5500	1000
0	19	55	45	7000	1000
00	19	55	45	7000	1000
000	19	55	45	7000	1000
0000	19	55	45	7000	1000
250 MCM	37	65	65	8000	1000

**ELECTRICAL SPECIFICATION 1541
DIVISION OF ELECTRICAL OPERATIONS
DEPARTMENT OF TRANSPORTATION
CITY OF CHICAGO
SEPTEMBER 16, 2004**

REINFORCING ROD FORMED STEEL CAGES

SUBJECT

1. This specification is for steel cages. The cages are to be used in street light pole foundations to provide the necessary strength to support street light poles.

DESCRIPTION

2.
 - (a) The steel must conform to the requirements of the American Society for Testing and Materials cited by ASTM designation number, of which the latest revision will govern.
 - (b) The steel cages must conform to all the requirements shown on Electrical Standard Drawing 793A.
 - (c) The steel cages must be constructed of number 3 and number 6 reinforcing bars, as shown on Electrical Standard Drawing 793A. Reinforcing steel must conform to ASTM A615, Grade 60, with a yield strength of 60,000 psi. All joints must be welded according to the latest recommendations of the American Welding Society's (AWS) Document 1.4.

ACCEPTANCE

3. If so requested, a sample cage must be delivered to the City within fifteen (15) business days of such request by the Chief Procurement Officer. The contractor must present certification that the steel used meets this specification. The City reserves the right to reject any cages which do not completely meet this specification.

DELIVERY

4. The Contractor must furnish and deliver the steel cages to the City of Chicago, Department of Transportation, Division of Electrical Operations, 4101 South Cicero Avenue, Chicago, Illinois 60650, or to a location as directed in the contract. Any cages that do not meet the specification or are delivered damaged will be rejected.

APPENDIX B – STORM WATER POLLUTION PREVENTION PLAN

FAI 90/94/290
 (Peoria Street)
 Section 2013-011R
 Cook County
 Contract No. 60W29



Storm Water Pollution Prevention Plan

Route	<u>F.A.I. 90/94/290</u>	Marked	<u>Peoria Street</u>
Section	<u>2013-011R</u>	Project No.	<u></u>
County	<u>Cook County</u>	Contract No.	<u>60W29</u>

This plan has been prepared to comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) Permit No. ILR10 (Permit ILR10), issued by the Illinois Environmental Protection Agency (IEPA) for storm water discharges from construction site activities.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John Fortmann, PE
 Print Name
Director of Highways, Region One Engineer
 Title
Illinois Department of Transportation
 Agency

Signature
10-11-13
 Date

I. Site Description:

A. Provide a description of the project location (include latitude and longitude):

Peoria Street over I-290 and the CTA Blue Line in the City of Chicago, Cook County, Illinois.

Latitude: 41° 52' 31.87" N
 Longitude: 87° 38' 58.22" W

B. Provide a description of the construction activity which is the subject of this plan:

The project is located along Peoria Street from Harrison Street to 100 feet south of Van Buren Street. The gross and net length of the project is 690 Feet (0.131 miles).

The work consists of the reconstruction of the Peoria Street Bridge (SN 016-1708) over Interstate 290 and the CTA from Harrison Street to 100 feet south of Van Buren Street. Also included in the work is modification of the Peoria Street CTA Station.

Work includes bridge reconstruction, roadway reconstruction, erosion control and protection, utility relocation of existing storm sewers, special waste excavation, temporary pavement for I 290, earth excavation and embankment, removal of existing improvements, new storm and combined sewers, curbs, pavements, sidewalks, pavement marking and signage, roadway lighting, concrete abutments, steel furnishing and erection, bridge deck and railings, traffic control and protection, urban enhancements and all incidental and collateral work necessary to complete the improvements as shown on the Plans and as described herein.

Rehabilitation of the UIC – Halsted Street Blue Line CTA Station includes demolition of the existing block station house on the bridge, renovation of the existing "Glassbox" adjacent to the west side of the bridge, installation of a new elevator west of the existing "Glassbox", construction of a new walkway to provide a closed link to the new elevator and replacement of the existing "Glassbox" roof. The renovated "Glassbox" will provide an area that will accommodate fare collection machines, turnstiles, exit gates and the agent's kiosk.

- C. Provide the estimated duration of this project:

15 months

- D. The total area of the construction site is estimated to be 1.98 acres.

The total area of the site estimated to be disturbed by excavation, grading or other activities is 1.27 acres.

- E. The following is a weighted average of the runoff coefficient for this project after construction activities are completed:

$$0.98 \text{ AC (0.3 PERVIOUS)} + 1.00 \text{ AC (0.9 IMPERVIOUS)} / 1.98 \text{ AC} = 0.60$$

The following is a weighted average of the runoff coefficient before construction activities are started:

$$0.84 \text{ AC (0.3 PERVIOUS)} + 1.14 \text{ AC (0.9 IMPERVIOUS)} / 1.98 \text{ AC} = 0.65$$

- F. List all soils found within project boundaries. Include map unit name, slope information, and erosivity:

The soil stratigraphy consists generally of, in descending order, the general lithological succession encountered beneath the pavement structure includes (1) man-made ground (fill); (2) very soft to medium stiff clay; (3) stiff to hard silty clay; (4) dense to very dense silty loam and sandy gravel; and (5) strong, good rock quality dolostone.

- G. Provide an aerial extent of wetland acreage at the site:

No wetlands are present at the site.

- H. Provide a description of potentially erosive areas associated with this project:

Potentially erosive areas are along the embankments adjacent to WB I-290 - where there are no retaining walls from the local road to the expressway.

- I. The following is a description of soil disturbing activities by stages, their locations, and their erosive factors (e.g. steepness of slopes, length of slopes, etc):

Stage 1A:

- Tree removal and protection
- Install the appropriate erosion control and sediment control items listed in the ESC plans.

- Existing utilities to be relocated by others as noted on the plans. The relocation of the existing utilities shall be coordinated with and is at the discretion of the utility agencies.
- Place the temporary shoring to support the existing CTA station on the west side of the bridge and the stairs on the east side of the bridge.
- Remove the CTA equipment in the existing brick house building on the bridge.
- Remove the existing brick house on the bridge.
- Relocate the existing electrical and communications conduits and cabling that are mounted to the underside of the platform where they interfere with the installation of the temporary platform support shoring and in areas where the platform will be removed for the proposed work.
- Relocate the ITS communications and power cable lines along EB and WB I 290 as shown on the plans.
- Remove the existing bridge mounted guide signs on Peoria Street and install the proposed bridge mounted signs on Morgan Street.
- Remove the existing Peoria Street Bridge superstructure, abutments, Pier 2 and approaches.
- Remove the existing concrete barrier wall along both shoulders of WB I-290 and the outside shoulder of EB I-290.
- Remove the curb and gutter along the outside shoulder of WB I-290.
- Construct all of the substructures except for Pier 1.
- Construct the temporary pavement (to remain) and concrete barrier wall along the outside shoulder of EB I-290 and inside shoulder of WB I-290. Construct the temporary pavement (to remain) and curb and gutter along the outside shoulder of WB I-290.
- Begin reconstruction of the siphon along Peoria Street.
- Begin construction of the north end of Peoria Street.
- Construct the stabilized construction entrance.
- Begin construction of the south end of Peoria Street.

Stage 1B:

- Install the appropriate erosion control and sediment control items listed in the ESC plans.
- Continue work along Pier 2 and the north abutment, if required.
- Remove the existing CTA PA speakers, CCTV cameras, communications signage and telephone equipment in the area of the platform renovation work. Turn over the devices to the CTA.
- Provide temporary conduits and cabling for the existing electrical, lighting, CCTV, PA System and communications systems that are mounted to the underside of the platform canopy and routed through the proposed work area. Maintain the existing platform level systems throughout construction.
- Remove the existing Pier 1.
- Remove the existing concrete barrier wall along the inside shoulder of EB I-290.
- Construct Pier 1.
- Construct the temporary pavement (to remain) and concrete barrier wall along the inside shoulder of EB I-290.
- Complete construction of the bridge superstructure, including bridge railings, bridge lighting and bridge deck latex concrete overlay.
- Remove the temporary shoring and re-attach the CTA station on the west side of the bridge and the stairs on the east side of the bridge to the new fascia beams.

- Complete reconstruction of the siphon along Peoria Street.
- Complete construction of the north end of Peoria Street.
- Construct the stabilized construction entrance.
- Continue construction of the south end of Peoria Street.

Stage 2:

- Rehabilitate the CTA station glass building.
- Remove and replace the existing CTA station platform, canopy and stairs for the new elevator and station house extension.
- Complete construction of the sidewalk on the south end of Peoria Street, including all drainage, earthwork, lighting and landscaping activities.

Stage 3:

- Remove the existing east sidewalk on the south end of Peoria Street and complete all earthwork and landscaping activities.
- Reconstruct the sections of sidewalk and curb and gutter along Harrison Street as shown on the plans.

J. See the erosion control plans and/or drainage plans for this contract for information regarding drainage patterns, approximate slopes anticipated before and after major grading activities, locations where vehicles enter or exit the site and controls to prevent offsite sediment tracking (to be added after contractor identifies locations), areas of soil disturbance, the location of major structural and non-structural controls identified in the plan, the location of areas where stabilization practices are expected to occur, surface waters (including wetlands) and locations where storm water is discharged to surface water including wetlands.

K. Identify who owns the drainage system (municipality or agency) this project will drain into:

City of Chicago / IDOT

L. The following is a list of receiving water(s) and the ultimate receiving water(s) for this site. The location of the receiving waters can be found on the erosion and sediment control plans:

The Peoria Street Bridge area drains to Pump Station 5, which then pumps to the South Branch Chicago River. The South Branch Chicago River is impaired for the designated use of fish consumption due to the PCBs. PCBs are not expected to be a pollutant associated with this contract. The South Branch Chicago River is not a Biologically Significant Stream.

M. Describe areas of the site that are to be protected or remain undisturbed. These areas may include steep slopes, highly erodible soils, streams, stream buffers, specimen trees, natural vegetation, nature preserves, etc.

None. Embankment slopes to be regraded and vegetation to be re-established.

N. The following sensitive environmental resources are associated with this project, and may have the potential to be impacted by the proposed development:

- Floodplain
- Wetland Riparian
- Threatened and Endangered Species
- Historic Preservation

- 303(d) Listed receiving waters for suspended solids, turbidity, or siltation
- Receiving waters with Total Maximum Daily Load (TMDL) for sediment, total suspended solids, turbidity or siltation
- Applicable Federal, Tribal, State or Local Programs
- Other

1. 303(d) Listed receiving waters (fill out this section if checked above):

- a. The name(s) of the listed water body, and identification of all pollutants causing impairment:
- b. Provide a description of how erosion and sediment control practices will prevent a discharge of sediment resulting from a storm event equal to or greater than a twenty-five (25) year, twenty-four (24) hour rainfall event:
- c. Provide a description of the location(s) of direct discharge from the project site to the 303(d) water body:
- d. Provide a description of the location(s) of any dewatering discharges to the MS4 and/or water body:

2. TMDL (fill out this section if checked above)

- a. The name(s) of the listed water body:
- b. Provide a description of the erosion and sediment control strategy that will be incorporated into the site design that is consistent with the assumptions and requirements of the TMDL:
- c. If a specific numeric waste load allocation has been established that would apply to the project's discharges, provide a description of the necessary steps to meet that allocation:

O. The following pollutants of concern will be associated with this construction project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Soil Sediment | <input checked="" type="checkbox"/> Petroleum (gas, diesel, oil, kerosene, hydraulic oil / fluids) |
| <input checked="" type="checkbox"/> Concrete | <input checked="" type="checkbox"/> Antifreeze / Coolants |
| <input checked="" type="checkbox"/> Concrete Truck Waste | <input checked="" type="checkbox"/> Waste water from cleaning construction equipment |
| <input checked="" type="checkbox"/> Concrete Curing Compounds | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Solid Waste Debris | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Paints | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Solvents | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Fertilizers / Pesticides | <input type="checkbox"/> Other (specify) |

II. Controls:

This section of the plan addresses the controls that will be implemented for each of the major construction activities described in I.C. above and for all use areas, borrow sites, and waste sites. For each measure discussed, the Contractor will be responsible for its implementation as indicated. The Contractor shall provide to the Resident Engineer a plan for the implementation of the measures indicated. The Contractor, and subcontractors, will notify the Resident Engineer of any proposed changes, maintenance, or modifications to keep construction activities compliant with the Permit ILR10. Each such Contractor has signed the required certification on forms which are attached to, and are a part of, this plan:

A. Erosion and Sediment Controls

1. **Stabilized Practices:** Provided below is a description of interim and permanent stabilization practices, including site specific scheduling of the implementation of the practices. Site plans will ensure that existing vegetation is preserved where attainable and disturbed portions of the site will be stabilized. Stabilization practices may include but are not limited to: temporary seeding, permanent seeding, mulching, geotextiles, sodding, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures. Except as provided below in II(A)(1)(a) and II(A)(3), stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than seven (7) days after the construction activity in that portion of the site has temporarily or permanently ceases on all disturbed portions of the site where construction will not occur for a period of fourteen (14) or more calendar days.

Where the initiation of stabilization measures by the seventh day after construction activity temporarily or permanently ceases is precluded by snow cover, stabilization measures shall be initiated as soon as practicable thereafter.

The following stabilization practices will be used for this project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Preservation of Mature Vegetation | <input checked="" type="checkbox"/> Erosion Control Blanket / Mulching |
| <input type="checkbox"/> Vegetated Buffer Strips | <input checked="" type="checkbox"/> Sodding |
| <input checked="" type="checkbox"/> Protection of Trees | <input type="checkbox"/> Geotextiles |
| <input checked="" type="checkbox"/> Temporary Erosion Control Seeding | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Temporary Turf (Seeding, Class 7) | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Temporary Mulching | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Permanent Seeding | <input type="checkbox"/> Other (specify) |

Describe how the stabilization practices listed above will be utilized during construction:

Refer to the Erosion and Sedimentation Control plan sheets for the contract for the specific stabilization practices called out for temporary and permanent conditions.

1. Preservation of Mature Vegetation: Mature vegetation shall be preserved as specified in the contract and at the direction of the Engineer.
2. Protection of Trees: Trees shall be protected as specified in the contract and at the direction of the Engineer.
3. Temporary Erosion Control Seeding: This item will be applied to all bare areas every seven days to minimize the amount of exposed surface areas. Earth stockpiles shall be temporarily seeded if they are to remain unused for more than 14 days. Within the construction limits, areas which may be susceptible to erosion as determined by the Engineer shall remain undisturbed until full scale construction is underway to prevent unnecessary soil erosion. Bare and sparsely vegetated ground in highly erodible areas as determined by the Engineer shall be temporarily seeded at the beginning of construction where no construction activities are expected within seven days.
4. Temporary Mulching: Mulch as applied to temporary erosion control seeding shall be by the method specified in the contract and at the direction of the Engineer. Mulch will be paid separately and shall conform to Section 251 of the Standard Specifications.
5. Erosion Control Blankets: Erosion control blankets will be installed with permanent seeding to protect slopes from rill and gully erosion and allow seed to germinate properly.

Describe how the stabilization practices listed above will be utilized after construction activities have been completed:

Permanent Stabilization – All areas disturbed by construction will be stabilized with permanent seeding or sodding immediately following the finished grading. Erosion control blankets will be installed with permanent seeding to protect the slopes from rill and gully erosion and allow seed to germinate properly.

Permanent Seeding: Seeding, Class 2A will be installed per IDOT specifications.

Sodding: This shall be applied as specified in the contract and at the direction of the Engineer.

2. **Structural Practices:** Provided below is a description of structural practices that will be implemented, to the degree attainable, to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Such practices may include but are not limited to: perimeter erosion barrier, earth dikes, drainage swales, sediment traps, ditch checks, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins. The installation of these devices may be subject to Section 404 of the Clean Water Act.

The following structural practices will be used for this project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Perimeter Erosion Barrier | <input type="checkbox"/> Rock Outlet Protection |
| <input type="checkbox"/> Temporary Ditch Check | <input type="checkbox"/> Riprap |
| <input checked="" type="checkbox"/> Storm Drain Inlet Protection | <input type="checkbox"/> Gabions |
| <input type="checkbox"/> Sediment Trap | <input type="checkbox"/> Slope Mattress |
| <input type="checkbox"/> Temporary Pipe Slope Drain | <input checked="" type="checkbox"/> Retaining Walls |
| <input checked="" type="checkbox"/> Temporary Sediment Basin | <input checked="" type="checkbox"/> Slope Walls |
| <input type="checkbox"/> Temporary Stream Crossing | <input type="checkbox"/> Concrete Revetment Mats |
| <input checked="" type="checkbox"/> Stabilized Construction Exits | <input type="checkbox"/> Level Spreaders |
| <input type="checkbox"/> Turf Reinforcement Mats | <input checked="" type="checkbox"/> Other (specify) Sump Pit |
| <input type="checkbox"/> Permanent Check Dams | <input checked="" type="checkbox"/> Other (specify) Stabilized Flow Line |
| <input type="checkbox"/> Permanent Sediment Basin | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Aggregate Ditch | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Paved Ditch | <input type="checkbox"/> Other (specify) |

Describe how the structural practices listed above will be utilized during construction:

Refer to the Erosion and Sedimentation Control plan sheets for the contract for the specific stabilization practices called out for temporary and permanent conditions.

1. **Perimeter Erosion Barrier:** As soon as reasonable access is available to all locations where water drains away from the project, perimeter erosion barrier shall be installed as called out in this plan and directed by the Engineer. Silt fences shall be placed along the contour at the limits in an effort to contain silt and runoff from leaving the site. Silt fence shall not be installed in areas of concentrated flow such as across ditches.

2. **Storm Drain Inlet Protection:** Sediment filters will be placed in all open lid inlets, catch basins and manholes during construction and will be cleaned on a regular basis.

3. **Stabilized Construction Exits:** Stabilized Construction Exits or Entrances will be provided by the Contractor. The entrance shall be maintained in a condition which shall prevent tracking or flowing of sediment onto Public-Right-Of-Way. Periodic Inspection and needed maintenance shall

be provided after heavy use and each rainfall event.

4. **Temporary Sediment Basin:** A temporary sediment basin will be used to temporarily collect runoff during construction. Water will be pumped out of the basin as needed. A filter bag will be required at the end of the discharge pipe.

5. **Stabilized Flow Line:** The Contractor shall provide to the RE a plan to have stabilized conveyance between upstream and downstream ends of storm sewer under construction when rain is forecasted, so that flow will not erode. This is important where new storm sewer connects to an existing storm sewer system. The use of a stabilized flow line between an installed storm sewer and open disturbance will reduce the potential for the offsite discharge of sediment-bearing waters.

All erosion control products furnished shall be specifically recommended by the manufacturer for the use specified in the erosion control plan prior to the approval and use of the product. The Contractor shall submit to the Engineer a notarized certification by the producer stating the intended use of the product and that the physical properties required for this application are met or exceeded. The contractor shall provide manufacturer installation procedures to facilitate the Engineer in construction inspection.

Describe how the structural practices listed above will be utilized after construction activities have been completed:

Once the construction is completed and the vegetation has been established, the perimeter barrier will be removed and areas disturbed by the removal will be stabilized with seeding and mulching.

3. **Storm Water Management:** Provided below is a description of measures that will be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed. The installation of these devices may be subject to Section 404 of the Clean Water Act.

a. Such practices may include but are not limited to: storm water detention structures (including wet ponds), storm water retention structures, flow attenuation by use of open vegetated swales and natural depressions, infiltration of runoff on site, and sequential systems (which combine several practices).

The practices selected for implementation were determined on the basis of the technical guidance in Chapter 41 (Construction Site Storm Water Pollution Control) of the IDOT Bureau of Design and Environment Manual. If practices other than those discussed in Chapter 41 are selected for implementation or if practices are applied to situations different from those covered in Chapter 41, the technical basis for such decisions will be explained below.

b. Velocity dissipation devices will be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g. maintenance of hydrologic conditions such as the hydroperiod and hydrodynamics present prior to the initiation of construction activities).

Description of storm water management controls:

Restrictors will be installed in all CDOT catch basins to reduce flow to the main sewers.

Storage pipes will be constructed to hold storm water surcharging in the existing drainage to pump station 5.

A detention tank will be constructed that will improve water quality in runoff from the 5-year and greater storms, south of the Circle Interchange, discharging to pump station 26.

Also, Phosphorous fertilizer has been eliminated from the project to reduce project impacts on the receiving waters.

4. **Approved State or Local Laws:** The management practices, controls and provisions contained in this plan will be in accordance with IDOT specifications, which are at least as protective as the requirements contained in the Illinois Environmental Protection Agency's Illinois Urban Manual. Procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by local officials shall be described or incorporated by reference in the space provided below. Requirements specified in sediment and erosion site plans, site permits, storm water management site plans or site permits approved by local officials that are applicable to protecting surface water resources are, upon submittal of an NOI, to be authorized to discharge under the Permit ILR10 incorporated by reference and are enforceable under this permit even if they are not specifically included in the plan.

Description of procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by local officials:

All management practices, controls, and other provisions provided in this plan are in accordance with "IDOT Standard Specification for Road and Bridge Construction" and "Illinois Urban Manual."

5. **Contractor Required Submittals:** Prior to conducting any professional services at the site covered by this plan, the Contractor and each subcontractor responsible for compliance with the permit shall submit to the Resident Engineer a Contractor Certification Statement, BDE 2342a.
- a. The Contractor shall provide a construction schedule containing an adequate level of detail to show major activities with implementation of pollution prevention BMPs, including the following items:
- Approximate duration of the project, including each stage of the project
 - Rainy season, dry season, and winter shutdown dates
 - Temporary stabilization measures to be employed by contract phases
 - Mobilization timeframe
 - Mass clearing and grubbing/roadside clearing dates
 - Deployment of Erosion Control Practices
 - Deployment of Sediment Control Practices (including stabilized construction entrances/exits)
 - Deployment of Construction Site Management Practices (including concrete washout facilities, chemical storage, refueling locations, etc.)
 - Paving, saw-cutting, and any other pavement related operations
 - Major planned stockpiling operations
 - Timeframe for other significant long-term operations or activities that may plan non-storm water discharges such as dewatering, grinding, etc.
 - Permanent stabilization activities for each area of the project
- b. The Contractor and each subcontractor shall provide, as an attachment to their signed Contractor Certification Statement, a discussion of how they will comply with the requirements of the permit in regard to the following items and provide a graphical representation showing location and type of BMPs to be used when applicable.
- Vehicle Entrances and Exits – Identify type and location of stabilized construction entrances and exits to be used and how they will be maintained.
 - Material Delivery, Storage and Use – Discuss where and how materials including chemicals, concrete curing compounds, petroleum products, etc. will be stored for this project.
 - Stockpile Management – Discuss what BMPs will be used to prevent pollution of storm water from stockpiles.
 - Waste Disposal – Discuss methods of waste disposal that will be used for this project.
 - Spill Prevention and Control – Discuss steps that will be taken in the event of a material spill (chemicals, concrete curing compounds, petroleum, etc.)
 - Concrete Residuals and Washout Wastes – Discuss the location and type of concrete washout facilities to be

used on this project and how they will be signed and maintained.

- Litter Management – Discuss how litter will be maintained for this project (education of employees, number of dumpsters, frequency of dumpster pick-up, etc.).
- Vehicle and Equipment Fueling – Identify equipment fueling locations for this project and what BMPs will be used to ensure containment and spill prevention.
- Vehicle and Equipment Cleaning and Maintenance – Identify where equipment cleaning and maintenance locations for this project and what BMPs will be used to ensure containment and spill prevention.
- Additional measures indicated in the plan.

III Maintenance:

When requested by the Contractor, the Resident Engineer will provide general maintenance guides to the Contractor for the practices associated with this project. The following additional procedures will be used to maintain, in good and effective operating conditions, the vegetation, erosion and sediment control measures and other protective measures identified in this plan. It will be the Contractor's responsibility to attain maintenance guidelines for any manufactured BMPs which are to be installed and maintained per manufacture's specifications.

The Contractor will be responsible for the inspection, maintenance and repair of all sedimentation and erosion control measures. If the Engineer notices or is notified of an erosion or sedimentation deficiency, the Engineer will notify the Contractor to correct it. All Offsite Borrow, Waste, and Use areas are part of the construction site and are to be inspected according to the language in this section and Section IV.

Seeding: All erodible bare earth will be temporarily seeded on a weekly basis to minimize the amount of erodible surface within the contract limits. Construction equipment shall be stored and fueled only at designated locations. All necessary measures shall be taken to contain any fuel or pollution runoff in compliance with environmental law and EPA Water Quality Regulations. Leaking equipment or supplies shall be immediately repaired or removed from the site. On a weekly basis, the Engineer shall inspect the project to determine whether erosion control efforts are in place and effective and if additional control measures are necessary. Sediment collected during construction by the various temporary erosion control systems shall be disposed on the site on a regular basis as directed by the Engineer and stabilized accordingly.

Temporary Erosion Control Seeding – Reapply seed if stabilization has not been achieved. Apply temporary mulch to hold seed in place if seed has been washed away or found to be concentrated in ditch bottoms. Restore rills, greater than 4 inches deep, as quickly as possible on slopes steeper than 1V:4H to prevent sheet-flow from becoming concentrated flow patterns.

Perimeter Erosion Barrier - This shall be inspected every 7 calendar days and after a storm event of 0.5 inch or greater (including snowfall). Repair when tears, gaps, leaning or undermining occur and restore erosion barrier taut. Repair or replace any missing or broken stakes immediately. Sediment will be removed if the integrity of the fencing is in jeopardy. Remove once permanent stabilization is established since it will no longer be necessary.

Erosion Control Blanket - Repair damage due to water running beneath the blanket and restore when displacement occurs. Reseeding may be necessary. Replace and re-staple all displaced erosion control blankets immediately.

Mulching – Mulch shall be placed at the base of trees or shrubs; never in drainageways; and on temporary or final seeded areas away from traffic where it would be blown away.

Sodding – Limit foot traffic to low use for the first two to three weeks. Ensure irrigation rate does not result in runoff. Install salt-tolerant sod where needed. Replace when >25% of any individual piece of sod is no longer viable. Restore areas where rolling edges are present or sod is displaced.

Storm Drain Inlet Protection – Remove sediment from inlet filter basket when basket is 25% full or 50% of the

fabric pores are covered with silt. Remove ponded water on road surfaces immediately. Clean filter if standing water is present longer than one hour after a rain event. Remove trash accumulated around or on top of practice. When filter is removed for cleaning, replace filter if any tear is present.

Protection of trees/temporary tree protection: Any protective measures which are knocked down shall be repaired immediately. Trim any cuts, skins, scrapes or bruises to the bark of the vegetation and utilize local nursery accepted procedures to seal damaged bark. Prune all tree branches broken, severed, or damaged during construction. Smoothly cut, perpendicular to the root, all cut, broken, or severed during construction, roots 1 inch or greater in diameter. Cover roots exposed during excavation with moist earth and/or backfill immediately to prevent roots from drying.

Temporary Sediment Basin – Remove accumulated silt when the basin becomes 50% filled. Maintain the outlet structure to prevent clogging. Correct erosion at outlet and provide stabilization if necessary.

Stabilized Construction Exits – Replenish stone or replace exit if vehicles continue to track sediment onto the roadway from the construction site. Sweep sediment on roadway from construction activities immediately. Use street sweeping in conjunction with this BMP to remove sediment not removed by the stabilized construction exit. All maintenance of erosion control systems will be the responsibility of the contractor until construction is complete and accepted by IDOT after final inspection.

Material Delivery and Storage – Document the various types of materials delivered and their storage locations in the SWPPP. Update the SWPPP when significant changes occur to material storage or handling locations and when they have been removed. Cleanup spills immediately. Remove empty containers.

Inspection of these areas shall be made at least once every seven days and within 24 hours of the end of each 0.5 inches or greater rainfall, or an equivalent snowfall. The project shall additionally be inspected by the Construction Field Engineer on a bi-weekly basis to determine that erosion control efforts are in place and effective and if other erosion control work is necessary.

All erosion and sediment control measures shall be maintained in accordance with the IDOT Erosion and Sediment Control Field Guide for Construction Inspection:

<http://www.dot.il.gov/desenv/environmental/idot%20field%20guide.pdf>

In additional, the following link may also be useful for maintenance:

<http://www.dot.il.gov/desenv/environmental/bestpractices.html>

IV Inspections:

Qualified personnel shall inspect disturbed areas of the construction site which have not yet been finally stabilized, structural control measures, and locations where vehicles and equipment enter and exit the site using IDOT Storm Water Pollution Prevention Plan Erosion Control Inspection Report (BC 2259). Such inspections shall be conducted at least once every seven (7) calendar days and within twenty-four (24) hours of the end of a storm that is 0.5 inch or greater or equivalent snowfall. All Offsite Borrow, Waste, and Use areas are part of the construction site and are to be inspected according to the language in this section.

If any violation of the provisions of this plan is identified during the conduct of the construction work covered by this plan, the Resident Engineer shall notify the appropriate IEPA Field Operations Section office by email at: epa.swnoncomp@illinois.gov, telephone or fax within twenty-four (24) hours of the incident. The Resident Engineer shall then complete and submit an "Incidence of Non-Compliance" (ION) report for the identified violation within five (5) days of the incident. The Resident Engineer shall use forms provided by IEPA and shall include specific information on the cause of noncompliance, actions which were taken to prevent any further causes of noncompliance, and a statement detailing any environmental impact which may have

resulted from the noncompliance. All reports of non-compliance shall be signed by a responsible authority in accordance with Part VI. G of the Permit ILR10.

The Incidence of Non-Compliance shall be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attn: Compliance Assurance Section
1021 North Grand East
Post Office Box 19276
Springfield, Illinois 62794-9276

V. Failure to Comply:

Failure to comply with any provisions of this Storm Water Pollution Prevention Plan will result in the implementation of a National Pollutant Discharge Elimination System/Erosion and Sediment Control Deficiency Deduction against the Contractor and/or penalties under the Permit ILR10 which could be passed on to the Contractor.



Contractor Certification Statement

Prior to conducting any professional services at the site covered by this contract, the Contractor and every subcontractor must complete and return to the Resident Engineer the following certification. A separate certification must be submitted by each firm. Attach to this certification all items required by Section II.5 of the Storm Water Pollution Prevention Plan (SWPPP) which will be handled by the Contractor/subcontractor completing this form.

Route	<u>F.A.I. 90/94/290</u>	Marked Rte.	<u>Peoria Street</u>
Section	<u>2013-011R</u>	Project No.	<u></u>
County	<u>Cook County</u>	Contract No.	<u>60W29</u>

This certification statement is a part of the SWPPP for the project described above, in accordance with the General NPDES Permit No. ILR10 issued by the Illinois Environmental Protection Agency.

I certify under penalty of law that I understand the terms of the Permit No. ILR 10 that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

In addition, I have read and understand all of the information and requirements stated in the SWPPP for the above mentioned project; I have received copies of all appropriate maintenance procedures; and, I have provided all documentation required to be in compliance with the Permit ILR10 and SWPPP and will provide timely updates to these documents as necessary.

- Contractor
- Sub-Contractor

<hr/>	<hr/>
Print Name	Signature
<hr/>	<hr/>
Title	Date
<hr/>	<hr/>
Name of Firm	Telephone
<hr/>	<hr/>
Street Address	City/State/ZIP

Items which this Contractor/subcontractor will be responsible for as required in Section II.5. of the SWPPP:

APPENDIX C – CHICAGO TRANSIT AUTHORITY CTA STATION SPECIFICATIONS

The description of the scope of work, method of measurement and basis of payment for the CTA Station are included in the main sections of the Special Provisions. The following CTA standard specifications are specifically utilized for the CTA Station related items.

INDEX OF SPECIFICATIONS FOR CTA STATION

DIVISION 01 – GENERAL REQUIREMENTS

01 30 00 _SUBMITTALS
01 45 80 _TESTING AND INSPECTION SERVICES

DIVISION 02 – EXISTING CONDITIONS

02 05 00 _DEMOLITION
02 10 00 _MAINTENANCE OF TRANSIT OPERATIONS
02 15 00 _TEMPORARY SHORING
02 25 80 _MICROPILES
02 45 00 _CAISSONS
02 61 00 _CONTAMINATED SOIL REMOVAL AND DISPOSAL

DIVISION 03 – CONCRETE

03 01 30 _MAINTENANCE OF CAST-IN-PLACE-CONCRETE
03 20 00 _CONCRETE REINFORCEMENT GALVANIZED
03 30 00 _CAST-IN-PLACE CONCRETE
03 31 10 _LATEX CONCRETE OVERLAY
03 40 00 _PRECAST CONCRETE
03 61 11 _NON-SHRINK GROUT

DIVISION 04 - MASONRY

04 21 50 _STRUCTURAL GLAZED FACING TILE

DIVISION 05 - METALS

05 10 30 _STRUCTURAL STEEL
05 31 00 _STEEL DECK
05 50 00 _METAL FABRICATIONS
05 50 40 _METAL STAIRS WITH CAST ABRASIVE TREADS
05 70 00 _DECORATIVE METAL PANELS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 00 _ROUGH CARPENTRY

INDEX OF SPECIFICATIONS FOR CTA STATION (continued)

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 11 50_BITUMINOUS DAMPPROOFING
07 21 00_BUILDING INSULATION
07 41 50_ALUMINUM ROOF PANELS
07 52 50_MODIFIED BITUMINOUS SHEET ROOFING
07 60 00_FLASHING AND SHEET METAL
07 70 00_ROOF SPECIALTIES AND ACCESSORIES
07 84 00_FIRESTOPPING
07 90 00_JOINT SEALERS

DIVISION 08 - OPENINGS

08 11 10_STANDARD STEEL DOORS AND FRAMES
08 13 00_STAINLESS STEEL DOORS AND FRAMES
08 41 10_ALUMINUM ENTRANCES AND FRAMING
08 71 00_FINISH HARDWARE
08 71 60_POWER DOOR OPERATORS
08 80 00_GLASS GLAZING
08 90 00_TRANSLUSCENT CANOPY SYSTEM

DIVISION 09 - FINISHES

09 21 00_GYPSUM BOARD ASSEMBLIES
09 30 10_TACTILE TILE
09 60 00_STONE FLOORING
09 65 13_RESILIENT WALL BASE AND ACCESSORIES
09 90 00_PAINTING
09 90 10_CLEANING AND PROTECTIVE COATINGS OF EXISTING SURFACES

DIVISION 10 - SPECIALTIES

10 20 00_LOUVERS AND VENTS
10 41 60_TRANSIT INFORMATION BOARDS
10 42 50_VITREOUS ENAMELED STEEL SIGNS
10 42 60_ILLUMINATED SIGNS
10 42 90_BRILLE TACTILE SIGNS
10 45 40_ROTOGATES
10 60 50_WIRE MESH PANELS AND FRAMES
10 80 00_TOILET ACCESSORIES
10 81 00_PIGEON CONTROL

DIVISION 11 - EQUIPMENT

11 24 24_ACCESS SUPPORT EQUIPMENT AND FALL RESTRAINT EQUIPMENT

INDEX OF SPECIFICATIONS FOR CTA STATION (continued)

DIVISION 12 - FURNISHINGS

12 87 20_STATION TRASH RECEPTACLES

DIVISION 13 - SPECIAL CONSTRUCTION

13 06 00_CUSTOMER ASSISTANT'S SHELTER

DIVISION 14 - CONVEYING EQUIPMENT

14 21 00_ELECTRIC TRACTION ELEVATORS

DIVISION 22 - PLUMBING

22 00 00_MECHANICAL GENERAL PROVISIONS

22 05 00_BASIC PLUMBING MATERIALS AND METHODS

22 07 00_PIPE INSULATION

22 40 00_PLUMBING

22 40 10_PREFABRICATED TRENCH DRAIN SYSTEM

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

23 00 00_HEATING, VENTILATING AND AIR CONDITIONING

23 07 00_MECHANICAL INSULATION

23 83 13_ELECTRIC HEAT TRACING SYSTEM

23 83 33_RADIANT HEATING UNITS

INDEX OF SPECIFICATIONS FOR CTA STATION (continued)

DIVISION 26 - ELECTRICAL

26 01 00_GENERALPROVISIONS
26 03 00_ELECTRICAL DEMOLITION
26 05 00_RACEWAYS AND BOXES
26 05 73_SHORT-CIRCUIT/COORDINATION & ARC FLASH STUDY
26 10 00_BASIC ELECTRICAL MATERIALS AND METHODS
26 12 30_WIRES CABLES SPLICES TERMINATIONS
26 14 10_WIRING DEVICES
26 17 00_LOCAL CONTROL
26 17 50_LOCAL CONTROL PANELS
26 19 00_GROUNDING
26 19 50_IDENTIFICATION
26 21 16_ELECTRICAL UTILITY SERVICE
26 25 10_AUTOMATIC TRANSFER SWITCH
26 33 53_UNINTERRUPTIBLE POWER SUPPLY SYSTEM
26 40 00_SERVICE EQUIPMENT - PASSENGER STATIONS
26 46 00_DRY TYPE TRANSFORMERS
26 47 00_PANEL BOARDS
26 49 00_GENERATOR TAP BOX
26 50 10_LIGHTING FIXTURES
26 55 60_LIGHT EMITTING DIODE (LED) SIGN BOX FOR INFORMATIONAL SIGNAGE
26 75 00_CABINET AND TERMINAL STRIPS
26 77 00_INFRARED HEATING
26 95 00_ELECTRICAL TESTING

DIVISION 27 - COMMUNICATIONS

27 00 10_COMMUNICATIONS GENERAL PROVISIONS
27 05 13.13_DIALTONE SERVICES
27 05 26_GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS
27 05 33_CONDUIT AND BACKBOXES FOR COMMUNICATION SYSTEMS
27 08 10_COMMISSIONING OF COMMUNICATION SYSTEMS
27 08 43_UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATION SYSTEMS
27 11 11_COMMUNICATION ROOM FINISHES
27 13 13_COMMUNICATIONS COPPER OUTSIDE PLANT CABLE
27 13 23_COMMUNICATIONS FIBER OPTIC OUTSIDE PLANT CABLE
27 15 13_COMMUNICATIONS COPPER HORIZONTAL CABLING
27 15 23_COMMUNICATIONS FIBER OPTIC HORIZONTAL CABLING
27 32 13_TELEPHONE SETS
27 32 26_HELP POINT TELEPHONE
27 42 16_DYNAMIC MESSAGE SIGN
27 51 17_PUBLIC ADDRESS SPEAKERS

INDEX OF SPECIFICATIONS FOR CTA STATION (continued)

DIVISION 28 – SECURITY SYSTEMS

28 16 19_INTRUSION DETECTION REMOTE DEVICES AND SENSORS

28 23 16_SECURITY VIDEO TERMINAL

28 23 31_CLOSED CIRCUIT TELEVISION FIXED CAMERAS

28 23 32_CLOSED CIRCUIT TELEVISION PTZ CAMERAS

28 31 00_FIRE DETECTION AND ALARM

DIVISION 31 - EARTHWORK

31 20 00_EARTHWORK

DIVISION 34 - TRANSPORTATION

34 11 00_BALLASTED TRACK CONSTRUCTION

DIVISION 36

36 12 50_UNDERGROUND TRACTION POWER CABLES

DIVISION 37

37 84 00_SIGNAL CABLE

SECTION 01 30 00
SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section addresses the procedural requirements for submittals including shop drawings, product data, samples, miscellaneous work-related submittals and to ensure that products are furnished and installed in accordance with design intent in accordance with the requirements specified in the special provisions.
- B. Make all submittals to IDOT unless otherwise directed by the Engineer.

1.02 QUALITY ASSURANCE

- A. Conform to requirements specified in the specifications, and as follows:
 - 1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the Contract Documents. Use all means necessary to fully coordinate all material including, but not necessarily limited to:
 - a. Determine and verify all interface conditions, catalog numbers, and similar data.
 - b. Coordinate with other trades as required.
 - c. Clearly indicate all deviations from requirements of the Contract Documents.
- B. Grouping of Submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.
- C. The Contractor, by affixing the Contractor's signature to each submittal, certifies that this coordination has been performed.

1.03 SUBMITTAL SCHEDULE

- A. General: the Contractor shall compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the Work. Include a list of each type of item for which Contractor's Drawings, Shop Drawings, Certificates of Compliance, material samples, guarantees, or other types of submittals are required.
- B. Coordination: Coordinate the submittal schedule with the construction Time Schedule to be submitted as required by the General Conditions. Coordinate the schedule with all (other) necessary Contractors and subcontractors and materials suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate, as required, to ensure the grouping of submittals.
- C. Revise and update the schedule on a monthly basis or more frequently as necessary to reflect conditions and sequences. Promptly submit revised schedules to the Engineer for review and comment.
- D. Mark each submittal with a permanent label providing the required information for proper

processing and recording of action taken as specified in the specifications.

- E. At the time the schedule is submitted, also submit for review a proposed format for transmittal of submittals, including means of identification and examples of the stamps indicating the Contractor's review or approval.

1.04 IDENTIFICATION OF SUBMITTALS

- A. Submit as required in the specifications.

1.05 TIMING OF SUBMITTALS

- A. General: Make all submittals far enough in advance of scheduled dates for installation to provide the appropriate time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.
 - 1. Advise the Engineer on each submittal, as to whether processing time is critical to the progress of the work, and if the work would be expedited if processing time could be shortened.
- B. Engineer's Review Time: In scheduling, allow at least 21 calendar days for review by the Engineer following receipt of the submittal. The Engineer will stamp all submittals "Received," and the date so stamped shall be the official receipt date.
- C. Delays: Delays caused by tardiness in receipt of submittals, incompleteness or rejection of submittals will not be an acceptable basis for extension of the Contract Completion Date.

1.06 SPECIFIC SUBMITTAL REQUIREMENTS

- A. General: Specific submittal requirements for individual units of work are specified in the applicable specification section. Except as otherwise indicated in the individual specification sections, comply with the requirements specified herein for each type of submittal.
- B. Contractor's Drawings:
 - 1. General as specified in the specifications and as follows:
 - a. The Contract Drawings show the general arrangement and such details as are necessary to provide a comprehensive description of the work to be performed.
 - b. As indicated below, prepare such Working and Shop Drawings as are necessary to adequately perform the Work.
 - c. Prepare all work and shop drawings on sheets measuring 22 inches by 34 inches unless otherwise approved by the Engineer. Provide each drawing with a blank area five inches by five inches, located adjacent to the title block for marking the record of the review process and the Engineer's "Action" marking. The title block should display the appropriate project identification.
 - 2. Shop and Working Drawings:
 - a. Definition - Working (or Design) Drawing:
 - 1) Working Drawings consist of plans for temporary structures such as decking, temporary bulkheads, support of excavation, support

of utilities, groundwater control systems and forming and falsework; for underpinning; and for such other work as may be required for construction but which does not become an integral part of the completed project. They should be accompanied by calculations or other sufficient information to completely explain the structure or system described and its intended manner of use and stamped by an Engineer registered in the State where the work is performed.

- 2) Coordinate drawings for work on utility facilities, streets and other facilities which are constructed for owners other than the so that information required by these owners is included on the Working Drawings for their facilities.
- b. Submittal: As specified in the specifications.
 - c. Scale and measurements: Make all Shop Drawings and Working Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.
 - d. Accurately and distinctly indicate the following:
 - 1) All working and erection dimensions.
 - 2) Arrangements and sectional views.
 - 3) Necessary details, including complete information for making connections between work under this Contract and work under other Contracts.
 - 4) Kinds of materials and finishes.
 - 5) Parts lists and descriptions thereof.
 - 6) On drawings for mechanical equipment, present where applicable, such data as dimensions, weight and performance characteristics. Show conformance with the performance characteristics and other data incorporated in the Contract Drawing and Specifications.
- C. Product Data: As specified in the specifications and also includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals (if any), special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.
1. Preparation: Collect required product data into a single submittal for each unit of work or system. Mark each copy to show which choices and options are applicable to the project. Where product data has been printed to include information on several similar products, some of which are not required for use on the project, or are not included in this submittal, mark the copies to show clearly that such information is not applicable.
 2. Submittal: As specified in the specifications.
 3. Final Distribution: Furnish copies of product data to subcontractors, suppliers, fabricators, manufacturers, installers, governing authorities and others as required for proper performance of the work. Show distribution on transmittal forms.
 4. Installation Copy: Do not proceed with installation of materials, products, and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.
- D. Samples: Submit samples for the Engineer visual review of general generic kind, color, pattern, and texture, and for a final check of the coordination of these characteristics with

other related elements of the work.

1. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.
 2. Preparation: Where possible provide samples that are physically identical with the proposed material or product to be incorporated in the work. Where variations in color, pattern, or texture are inherent in the material or product represented by the sample, submit multiple units of the sample (not less than 3 units), which show the approximate limits of variations. Where samples are specified for the Engineer's selection of color, texture or pattern, submit a full set of available choices for the material or product. Mount, display, or package samples in a manner to facilitate the review of indicated qualities.
 3. Submittal:
 - a. Label each sample indicating:
 - 1) Name of Project and Contract Number.
 - 2) Name of Contractor and Subcontractor.
 - 3) Material or equipment represented.
 - 4) Source.
 - 5) Name of producer and brand (if any).
 - 6) Specification Section, article of paragraphs.
 - 7) Location in Project.
 - b. Distribution of Samples: Maintain the final submittal sets of samples, as returned by the Engineer, at the project site, available for quality control comparisons throughout the course of performing the work. Prepare and distribute additional sets of samples to subcontractors, suppliers, fabricators, manufacturers, installers, governing authorities, and others as required for proper performance of the work. Show final distribution on transmittal forms.
 4. Mockups and similar samples specified in individual work sections are special types of samples. Comply with sample submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.
- E. Miscellaneous Submittals: Submit documentation such as reports, test results, permits, certificates, delivery tickets, etc., as specified in the various Sections of these specifications.
1. Colors and Patterns: Unless the precise color and pattern is specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts to the Engineer.
 2. Inspection and Test Reports: Conform to requirements specified in Section 01 45 80 Testing and Inspection and as specified in the specifications.
 3. Warranties: Refer to Technical Specifications for specific general requirements on warranties, product bonds, workmanship bonds, and maintenance agreements. In addition to copies desired for the Contractor's use, furnish 2 executed copies of such warranties, bonds or agreements. Provide 2 additional copies where required for maintenance manuals.
 4. Certificates of Compliance: Submit to the Engineer all Certificates of Compliance for material approval prior to installation of material as follows:

- a. Certify that all materials used in the Work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on selected samples, by the Contractor or by the Engineer, the material is found to not meet specified requirements.
 - b. Show on each certification the name and location of the Work, name and address of Contractor, quantity and date or dates of shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.
 - c. In addition to the above information, all laboratory test reports submitted with Certificates of Compliance shall show the date or dates of testing, the specified requirements for which testing was performed, and results of the test or tests.
 - d. Provide three copies of all certificates, except as otherwise specified.
5. Permits: As specified in the specifications.
 6. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Engineer's use. Where workmanship, whether at the project site or elsewhere is governed by a standard, furnish additional copies of the standard to fabricators, installers and others involved in the performance of the work.
 7. Closeout Submittals: Refer to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.
 8. General Distribution: Provide additional distribution of submittals to subcontractors, suppliers, fabricators, installers, governing authorities, and others as necessary for the proper performance of the work.

END OF SECTION 01 30 00

SECTION 01 45 80
TESTING AND INSPECTION SERVICES

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall provide an independent testing laboratory to perform specified services listed; Testing and Inspection; and as noted in other sections of this Specification.
- B. Contractor's Obligations
 - 1. Testing and inspection by the Contractor shall in no way relieve the Contractor's obligations to perform the work of the contract herein specified.
 - 2. Testing shall be required on all work to show compliance with the Contract Documents whether or not they are specifically indicated, at no additional cost to the IDOT.
 - 3. After testing, should any material or work be found to be defective or inferior, such material and/or work shall be removed and replaced with new sound material and/or work. Removal and replacement shall be at the Contractor's expense. A retest of new material and/or work will be performed at the Contractor's expense.

1.02 CONTRACTOR'S TESTING AND INSPECTION AGENCY

- A. The Contractor shall provide and pay for all tests and inspections, other than those to be performed by IDOT, to show that requirements of the Contract have been fulfilled and for all tests required by law, ordinances, rules and regulations governing the work.
- B. The Contractor shall submit the names, qualifications and scope of services of each independent testing agency within 30 days of the Contractor's Notice to Proceed for the IDOT's approval.
- C. Contractor shall submit one (1) certified original of each test result and/or report.
- D. Contractor shall submit a copy of the Inspection Report of the Testing and Inspection Agency employed by Contractor made by the Materials Reference Laboratory of the National Bureau of Standards during its most recent tour of inspection, with memorandum of remedies of any deficiencies reported during the inspection.

1.03 QUALIFICATIONS OF CONTRACTOR'S TESTING AND INSPECTION AGENCIES:

- A. Agencies shall meet "Recommended Requirements for Independent Laboratory Qualification," published by the American Council of Independent Laboratories.
- B. Agencies shall meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."
- C. Agencies shall be authorized to operate in the State of Illinois.
- D. The Agencies' testing equipment shall be calibrated at required intervals with proof of calibration by devices of accuracy traceable to either:
 - 1. National Bureau of Standards

2. Accepted values of natural physical constants.

1.04 DUTIES OF CONTRACTOR'S TESTING AND INSPECTION AGENCIES:

- A. The duties of the Contractor's Testing and Inspection Agency include the following:
1. Provide qualified personnel to perform required inspections.
 2. Cooperate and comply with the requirements of IDOT and Contractor;
 3. Perform specified inspections, sampling and testing of materials of construction as required or requested by the IDOT to ascertain compliance of materials and workmanship with the requirements of the Contract Documents;
 4. Within 24 hours of observation, notify IDOT and Contractor, in writing, of any observed irregularities or deficiencies of the work, materials or products;
 5. Within 24 hours of inspection or receipt of test results, transmit to IDOT the report of each test and inspection. Each report shall include, as a minimum, among other items:
 - a. Date issued.
 - b. Project name and number.
 - c. Testing and Inspection Agency name, address and telephone number.
 - d. Name and signature of inspector.
 - e. Date and time of sampling, inspection or testing.
 - f. Record of temperature and weather conditions.
 - g. Identification of products and specifications section.
 - h. Location of sample or test in the project
 - i. Designation of the work and type of inspection or test.
 - j. Results of tests and compliance with Contract Documents.
 - k. Interpretation of test results including comments or professional opinion as to whether inspected or tested work complies with the Contract requirements.
 - l. Recommendations on retesting if the tested or inspected work is not in compliance.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall cooperate with IDOT with regard to their determinations of the Contractor's compliance with the contract requirements and shall provide access to the work.
- B. Submit the concrete design mix proposed to be used and other specification requirements which require testing and control by IDOT.
- C. Furnish copies of product test reports.
- D. Furnish incidental labor and facilities:
 1. To provide access to the work to be tested;
 2. To facilitate inspections and tests;
 3. For storage and curing of test samples.
- E. Notify the Testing and Inspection Agency and the CTA well in advance of operations to allow for assignment of their personnel and scheduling of tests.
- F. At the discretion of IDOT, the Contractor may be required to employ and pay for the services of a separate, equally qualified independent Testing and Inspection laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with the Contract Documents.

- G. Contractor shall pay for all costs related to products and/or material testing, in accordance with established requirements and as specified.

PART 2 PRODUCTS (NOT REQUIRED)

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, the Contractor shall repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar service.
- D. The Contractor shall be responsible for the time and cost to repair any damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes caused either directly or indirectly by testing or the testing agency.

END OF SECTION 01 45 80

SECTION 02 05 00
DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the demolition, removal and proper disposal of the items indicated on the drawings to be removed and any other items to be removed as required to facilitate the installation of the new work; including the following: This item consists of providing all labor and materials required for demolition, removal and disposal of the structural boarding platform, platform canopy and station level components as indicated on the drawings including but not limited to: platform slab, longitudinal and transverse concrete beams, a caisson, a steel stair, and aluminum canopy columns, portion of platform canopy and station structural elements and finish materials. Included are finish materials, mechanical, plumbing, electrical and communications items to be removed, salvaged or relocated as a result of the demolition work. Also included is removal of existing CTA equipment, existing stationhouse skylights, exterior glass wall panels, stair and demolition of portion of existing platform and canopy
1. Remove existing plumbing supply, drain and vent piping, etc. integral with the work, to the extent shown on the drawings, and as otherwise required. Cap piping as required.
 2. Remove existing light fixtures, electrical outlets, wiring, conduit, etc. integral with the work, to the extent shown on the drawings, and as otherwise required. Cap wiring and conduit as required.
 3. Remove and dispose of the trench drain, platform canopy and station level components as indicated on the drawings including but not limited to: platform slab, longitudinal and transverse concrete beams, caisson, steel stair, and aluminum canopy columns, portion of platform canopy and station structural elements and finish materials.
 4. Included in the Removals are finish materials, mechanical, plumbing, electrical and communications items to be removed, salvaged or relocated as a result of the demolition work.
 5. Remove all other items as shown, indicated, or as otherwise required to facilitate the new construction.
- B. Salvageable items to be reused are to be removed carefully to avoid damage to the items, including the following:
1. Existing exterior light fixtures.
 2. Existing CTA Logo (sign).
- C. Work includes providing, installing, maintaining and removing temporary construction barriers as required during the course of the work. Construction barriers to be of plywood and wood framing unless approved otherwise.
- D. Work includes providing, installing and removing foot traffic barricades and control devices and signage as required during the course of the work and as approved by the Authority.
- E. Contractor is to schedule all work with the Authority. Contractor to submit a process plan and phasing plan for all the work, including demolition.
- F. Contractor to protect the remainder of the existing building during demolition and construction. The building must be protected from moisture, the elements and extreme

temperatures. The equipment within or inside the building must be protected from dust, debris, the elements and other damage during the demolition and construction. Coordinate all work with the Authority.

- G. Work will require re-routing underground duct banks containing utility lines for the new construction.
- H. Work will require re-routing underground utility lines as required to clear the new construction.
- I. Work includes patching and repairs to existing adjacent surfaces after removal or demolition. Patching and repairs to match existing materials and finishes.
- J. Work includes coring and cutting existing surfaces for installation of new plumbing piping and electrical conduit. Patch upon completion.
- K. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section "Summary of Work".
 - 2. Division 01 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
 - 3. Division 06 Section "Carpentry" for material and construction requirements for temporary enclosures.

1.02 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Authority's property.
- B. Remove and Salvage for Recycling: Items indicated to be removed and recycled are to be separated and arranged for recycling. Construction debris from demolition and construction waste materials are to be picked up by recycling waste haulers for recycling to the greatest extent possible. As a minimum requirement, the Contractor to follow the City of Chicago Ordinance for recycling construction debris.
- C. Remove and Salvage for Re-use: Items indicated to be removed and salvaged remain the Authority's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Authority's designated storage area.
- D. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- E. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Authority, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.03 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged for re-use, reinstalled, or otherwise indicated to remain the Authority's property, demolished materials shall become the Contractor's property and shall be removed from the site and legally disposed of by the Contractor.

1.04 SUBMITTALS

- A. General: Submit each item in this Article according to the conditions of the contract and Division 01 Specification Sections, for approval, unless otherwise indicated:
1. Proposed dust-control measures.
 2. Proposed noise-control measures.
 3. Schedule of demolition activities indicating the following:
 - a. For each location: Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
 - b. Interruption of utility services.
 - c. Coordination for shutoff, capping, and continuation of utility services.
 - d. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Authority's on-site operations.
 - e. Locations of temporary partitions, barriers and means of egress.
 - f. Foot traffic control or interruption. Closing of areas.
 - g. Shoring required.
 - h. Indicate how demolition work will avoid interruption of Authority's on-site operations.
 - i. Demolition plan.
 4. Proposed recycling procedures.
 5. Inventory of items to be removed and salvaged for re-use
- B. Contractor to submit a process plan and phasing plan for the demolition work.
- C. Contractor to submit proposed barricades, control devices and signage as required during the demolition and other work; including the proposed location of the barricades, control devices and signage; and the materials proposed to be used for the barricades, control devices and signage; for the Authority's review and approval.
- D. Provide the following, for information purposes:
1. Photographs or videotape for information purposes, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.
- E. Provide the following at Project Closeout according to Division 01 Section "Project Closeout":
1. Record drawings; including identification and accurate locations of capped utilities and other subsurface structural, electrical, or mechanical conditions.
- F. Provide written and dated documentation of the total amount of each different waste material, the amount of each sent to a recycling facility and the amount of each sent to a landfill. Documentation shall be done on a daily basis. Indicate when and who the materials were picked up by and the name of the recycling facility the materials were sent to.

- G. A demolition plan is to be submitted to the Authority for approval. Demolition shall not commence until the contractor has received written approval from the Authority.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with City of Chicago Recycling Ordinance.

1.06 PROJECT CONDITIONS

- A. Contractor required to survey existing conditions to verify all existing dimensions and conditions, locations of items and construction sizes of items and including conditions and limitations under which he is to do his work.
- B. Contractor required to locate all existing utilities and other improvements, including utilities not exposed to view.
- C. There will be no extras allowed to compensate Contractor for his failure to review and verify existing conditions and dimensions.
- D. Demolition work to adhere to phasing plans for the project.

1.07 HAZARDOUS MATERIALS

- A. The Authority has determined that various components to be removed or to be painted may contain lead paint. These components shall be removed according to all applicable federal, state and local regulations including. This shall include 29 CFR1926.62 and 29 CFR1910.1025 under the Occupational Safety and Health Act, Toxic Substance and Control Act, Resource Conservation and Recovery Act, Illinois Lead Poisoning Prevention Act (77 Illinois Adm. Code 845) and City of Chicago Code 11-4-2190 (Sandblasting, grinding and chemical washing of building, facilities or other structures; permit and notification requirements; performance standards for lead paint abatement; and disposal of debris.) Contractor shall submit removal or mitigation plan to the Authority for approval.
- B. For structures noted to be re-painted; existing paint that is loose, flaking, or otherwise not recommended to remain under the new paint system; is to be removed and, unless determined otherwise, should be assumed to contain lead. The following lead paint removal procedures shall be followed:
 1. Work is governed by OSHA Regulations (worker protection) and NESHAP Regulations (visible emissions).
 2. City of Chicago Sandblasting, Grinding and Chemical Washing Ordinance is not applicable as long as hand scrapping removal method is used. Any mechanical methods or chemical removal would require City permits. CTA Facilities Maintenance shall coordinate with Environmental Affairs if Permits are required.
 3. Employees conducting lead abatement shall be licensed by IDPH as a lead abatement worker and/or supervisor.
 4. Lead paint work area shall be separated by caution tape or other appropriate barrier.
 5. Work area shall be covered with appropriate non-skid (canvas) tarpaulin. This tarpaulin shall be cleaned with a HEPA vacuum after each shift or prior to moving tarpaulin. Paint chips and collected dust shall be bagged and disposed of as lead waste. Contact Environmental Affairs (312-681-3869) for disposal.
 6. Employee shall wet impact surface to prevent dust during scraping activity.
 7. Employees shall wear disposable coveralls during lead abatement activity.

- Coveralls shall be disposed as lead waste.
8. Employees shall wear appropriate respirators. CTA may conduct air sample (negative exposure assessment) to determine airborne lead dust exposure.
 9. Employees shall maintain good personnel hygiene by washing their hands and face prior to eating, drinking, smoking, or leaving the site.
- C. Other than the lead paint referred to above, the Contractor is not responsible to remove hazardous material that is encountered in the course of the work and not identified as hazardous material in the contract documents or otherwise addressed in the contract documents. If previously unidentified hazardous material is encountered, do not disturb the materials. An asbestos inspection was performed on September 4, 2013 and no asbestos containing material was found. Immediately notify the Authority for direction and arrangement for proper removal by licensed asbestos abatement workers and proper disposal.
- D. Material containing lead based paint to be disposed of as hazardous waste, according to all applicable laws and regulations, unless approved otherwise, at Contractor's expense and at approved landfills. Do not allow lead dust to contaminate other surfaces. The Contractor shall be responsible for handling, transporting, and disposing of any hazardous materials generated during the course of the project in accordance with all applicable federal, state and local environmental regulations and codes.

PART 2 PRODUCTS

2.01 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that those utilities indicated and approved to be disconnected and capped, have been properly done so.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required. All work indicated may vary based on actual field conditions and dimensions. Additional demolition and/or patching may be required depending on the condition of materials and construction upon opening up the existing construction and actual justification and/or attachment of the materials.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Authority.
- D. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

- E. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Authority and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Authority and to governing authorities.
 - a. Provide not less than 72 hours' notice to Authority if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.
- C. Utility Requirements: Refer to their respective sections of these specifications for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

- A. Conduct demolition operations and remove debris to ensure minimum interference with adjacent occupied and used facilities.
 - 1. Do not close or obstruct adjacent occupied or used facilities without permission from Authority and authorities having jurisdiction. Provide alternate routes around closed or obstructed foot traffic ways.
 - 2. Do not block required exits or stairways.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent facilities to remain. Ensure safe passage of people around selective demolition area.
 - 1. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
 - 2. Cover and protect equipment that has not been removed.
- C. Erect and maintain dust-proof partitions and temporary enclosures as required to limit dust and dirt migration and to separate areas from fumes and noise.
- D. If required, provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building components during selective demolition and until new support is installed.

3.04 POLLUTION CONTROLS

- A. Use temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.05 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated on the drawings. Use methods required to complete work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 8. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
 - 9. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish masonry in small sections. Cut masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools. Sawcut between existing masonry to be removed and to remain.
- C. Demolish and remove existing construction according to the IDOT Standard Specifications for Road and Bridge Construction, Section 501, Removal of Existing Structures.
- D. The Contractor is fully responsible for the means and method of demolition and the integrity and stability of the existing structure during demolition until the work is completed.
- E. Do not remove more of the existing structure than indicated on the drawings or as required. Do not damage, mar, cut or deface the remaining structure to remain or material to be reused.
- F. Verify all dimensions and existing conditions.

3.06 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused by demolition operations to match adjacent construction.
- B. Patching is specified in Division 01 Section "Cutting and Patching."
- C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials. Patch to match existing, using materials to match existing.
 - 1. Completely fill holes and depressions in existing masonry or concrete to remain with an approved masonry or concrete patching material, applied according to manufacturer's printed specifications.
- D. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- E. Patch and repair floor, ceiling and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.
 - 1. Closely match texture and finish of existing adjacent surface.
 - 2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
 - 4. Where applicable, remove existing floor and wall finishes and replace with new materials, if necessary, to achieve uniform color and appearance.
- F. Repairs, patching and replacements due to damage by the Contractor are the complete responsibility of the Contractor.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials, accumulated debris, rubbish, and other materials resulting from demolition operations. Do not allow demolished materials to accumulate on-site except as required for recycling operations.
- B. Recycle construction debris from demolition operations and construction waste to the greatest extent possible. Contractor must follow City of Chicago Recycling of Construction Debris Ordinance as a minimum requirement.
- C. Concrete, masonry, steel, wood, glass, cardboard and other materials shall be separated at the construction site and pick up shall be arranged with their respective recycling waste haulers for recycling of the individual waste materials.
- D. Provide written and dated documentation of the total amount of each different waste material, the amount of each sent to a recycling facility and the amount of each sent to a landfill. Documentation shall be done on a daily basis. Indicate when and who the materials were picked up by and the name of the recycling facility the materials were sent to.
- E. Disposal of non-recyclable debris: Transport materials that are not suitable for recycling off Authority's property and legally dispose of them.

3.08 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.
- B. Sweep the building broom clean on completion of selective demolition operation.
- C. Change filters on air-handling equipment on completion of selective demolition operations.

END OF SECTION 02 05 00

SECTION 02 10 00
MAINTENANCE OF TRANSIT OPERATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes requirements for maintaining transit operations around the work area. These requirements augment all other requirements given within the Contract Documents for maintaining and controlling pedestrian access to active work areas.
- B. Elements included:
 - 1. Requirements for maintaining boarding access at platform level
 - 2. Temporary platform structures, as applicable
 - 3. Barricades or similar pedestrian control devices
 - 4. Signage
 - 5. Temporary lighting in boarding areas
- C. All requirements listed in the CTA Flagging and Coordination Special Provision apply to this section.

1.02 PROJECT CONDITIONS

- A. The Chicago Transit Authority (CTA) is an operating transportation agency and must maintain rail and bus operations at all scheduled times for the benefit of the public. The Contractor shall conduct his operations in such a manner as not to cause damage to the CTA equipment, put the public or CTA personnel in danger, cause inconvenience to the customers, interrupt train service (except as permitted within the Contract Documents) or cause avoidable inconvenience to the public.
- B. Peak Hour (8-Car Train) Platform Work Area Requirements
 - 1. Public access to the Morgan Street and Halsted Street ramps shall be maintained at all times.
 - 2. The entire length of the platform from Halsted Street to Morgan Street shall be available to the CTA for passenger operations during all hours where 8-car or longer trains are operated. This is generally weekdays from 4am until midnight and special events. CTA reserves the right to change the train schedule which may affect when the entire platform is required to be available.
 - 3. Available for passenger services requires:
 - a. A 4'-6" boarding area be clear on both sides of the platform from Column Line 13 to the Halsted Street Ramp. The 4'-6" dimension is from the edge of the platform to the centerline. No obstructions shall be in this area.
 - b. A 4'-0" walking path be available from the Morgan Street Ramp to Column Line 13.
- C. Off-Peak Hour (4-Car Train) Platform Work Area Requirements
 - 1. Public access to the Halsted Street ramp shall be maintained at all times. With prior approval from the CTA, access to the Morgan Street ramp may be closed to the public. All requests for closure of the Morgan Street entrance must be submitted twenty-one (21) days in advance for review and approval by CTA. Requests must correspond with an approved construction process plan that

- documents the work that requires the closure with necessary barriers, signage, and other devices to protect the public from entering the work area.
2. The platform area east of Column Line 20 to the Halsted Street Ramp shall be available to the CTA for passenger operations at all times.
 3. Available for passenger services requires:
 - a. A 4'-6" boarding area be clear on both sides of the platform. The 4'-6" dimension is from the edge of the platform to the centerline. No obstructions shall be in this area.
 4. The platform area west of Column Line 20 to the Morgan Street Ramp may be taken out of active boarding service as demonstrated to be required to safely perform the necessary platform level construction. All requests for closure of this platform area must be submitted twenty-one (21) days in advance for review and approval by CTA. Requests must correspond with an approved construction process plan that documents the work that requires the closure with necessary barriers, signage, and other devices to protect the public from entering the work area.
 5. The CTA will make all final determinations on if the platform and Morgan Street ramp will be closed to the public. Determinations will be based upon a demonstrated need to restrict public access for safety to allow the Contractor to perform the necessary construction activities. If, in the determination of the CTA, the Contractor has options that would allow for public access to perform the construction activities, the CTA may elect to deny the request. If the Contractor does not appropriately use all closures in an efficient and effective manner, the CTA may elect to deny future requests until the Contractor demonstrates he will fully utilize the platform closure time.

1.03 SUBMITTALS

A. Construction Process Plan

1. For all work that will occur within areas of passenger occupation, provide a construction process plan that outlines the following:
 - a. Applicable Contract Documents
 - b. Options
 - c. Possible Conflicts
 - d. Compatibility Problems
 - e. Time Schedules
 - f. Weather Limitations
 - g. Temporary Facilities & Storage
 - h. Space and Access Limitations
 - i. Governing Regulations
 - j. Safe Work Plans (including Hazard Analysis)
 - k. CTA Operations Impact
 - l. Access Plan
 - m. Work Zone Protection Methods
2. Construction process plan shall be submitted twenty-one (21) days prior to any work that would disrupt passenger activities.

B. Product Data for each type of material used for the maintenance of transit operations, including but not limited to:

1. Barricades or similar pedestrian control devices
2. Temporary signs

3. Materials used in temporary platform structures
 4. Temporary lighting
- C. Shop drawings for all temporary platform structures and barriers showing fabrication. Drawings shall be of a sufficient detail to show compliance with all requirements.
- D. Structural calculations sealed by an Illinois Registered SE for all temporary platform structures or barriers that are not a pre-manufactured product providing the necessary loading criteria.
- E. Plan for any activities that will require cutting or patching of the existing construction that is to remain.
1. Describe the extent of the cutting and patching required and how it will be performed; indicate why it cannot be avoided.
 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 3. List products to be used and firms or entities that will perform the work.
 4. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 5. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
 6. Approval by CTA / IDOT to proceed does not waive the CTA's right to later require complete removal and replacement of a part of the work found to be unsatisfactory.
- F. Signage plans for all signs associated with work areas in active public areas and platform closure work areas.

1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
1. Building code requirements.
 2. Health and safety regulations.
 3. American with Disabilities Act (ADA) requirements.
 4. State of Illinois Manual on Uniform Traffic Control Devices (MUTCD).
 5. NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
- C. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials. If acceptable to the Authority, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."
1. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated.
 2. For fences and vision barriers, provide minimum 3/8-inch thick exterior plywood.
 3. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch thick exterior plywood.
 4. Plywood used for temporary partitions shall be exterior, CDX or better grade. The use of oriented strand board (OSB) will not be permitted for partitions.
 5. Any sharp edges, protruding fasteners, splinters, or structural instability for conditions will be corrected by the contractor immediately.
- C. Paint: Comply with requirements of Division 9 Section "Painting."
1. For job-built fences and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
 2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
 3. All graffiti shall be removed within 24 hours.
- D. Open-Mesh Fencing: Provide 0.120-inch thick, galvanized 2-inch chainlink fabric fencing 6 feet high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches I.D. for line posts and 2-1/2 inches I.D. for corner posts.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for illumination requirements given in Part 3. Provide guard cages or tempered glass enclosures. Provide exterior fixtures where exposed to moisture. Wiring shall comply with NEC requirements for exterior exposure.
- F. Tactile Tile: Tactile tile shall conform with the requirements of Technical Specification 093010.
- G. For any materials not specified but used in any temporary work or cutting / patching associated with temporary work, comply with the appropriate sections of the Technical Specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required.

3.02 TEMPORARY PLATFORM STRUCTURES

- A. The removal of portions of the existing platform are within areas that must be open for passenger operations during peak hours as defined above. The Contractor shall be required to provide temporary bridges or platform structures to allow for the passenger boarding or pathway usage as outlined above.
- B. All temporary platform structures shall meet the following requirements:
 - 1. Live loading: 100 PSF as shown in manufacturer standard literature or in sealed engineering calculations by an Illinois Registered SE.
 - 2. Slip resistance: Coefficient-of-friction of 0.50 or greater. This can be achieved by provided a grooved surface or by applying slip resistant coatings or materials.
 - 3. Levelness: All changes in level from the adjacent platforms shall comply with the ADA requirements of no greater than 1/4" for vertical change or 1/2" with a bevel. Anything larger than 1/2" shall be treated as a ramp. Any changes in level shall be identified with the edges painted in a 4" wide safety yellow band.
 - 4. Gaps: No horizontal gap shall be greater than 1/4".
 - 5. Deflection limit: L/360 or 1/4", whichever is less.
 - 6. If any of the temporary platform structures include the edge boarding area, tactile tile will be provided on the temporary platform structure to the same dimensions as the adjacent platform. Color shall match existing.
 - 7. All materials shall meet a Class B Flame Spread per ASTM E 84.
 - 8. All materials shall be non-conductive.
- C. The first use of a temporary platform structure shall require the inspection and approval of CTA prior to the area being restored to service to the public. The Contractor shall arrange the work schedule to allow for the inspection, time for modifications, and reinspection. Failure to properly schedule the inspection and approval to reopen the platform on time may result in penalties being assessed if the CTA cannot resume normal operations per approved schedule.

3.03 BARRICADES

- A. Barricades shall be provided to prevent public access into active work areas or to block areas of removed platform for fall protection.
 - 1. Permanent barricades shall be provided at the base of the eastern main stair and eastern exit only stair at the platform level to prevent any public access into the Peoria Station. These shall be installed with the closure of the Peoria Station and remain in place until it is reopened.
 - 2. Permanent barricades shall be provided at the main entrance at bridge level after the bridge is reopened to pedestrian traffic but prior to the station being open.
 - 3. Temporary barricades shall be provided when portions of the platform area are placed out of public usage for construction activities.

4. Temporary barricades shall be provided, as required, for safety to shield the public from active work areas contained within the operating platform.
- B. Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against.
1. Approved fencing shall be provided to separate restricted work-hour area from the unrestricted work-hour area. The exact location and number of the barriers shall be approved by the CTA.
 2. Provide barriers, signage, or other approved means to warn pedestrians of the work of this project and protect personnel and the public from dust, falling debris, and other damage or injury.
 3. Plastic Flexible Barriers:
 - a. Use of Plastic Flexible Warning Fencing is prohibited for use as temporary storage enclosures in all public access areas. The Plastic Flexible Warning Fencing/Netting should only be used as a visual warning barrier for day work, and such applications shall be requested of, and approved in writing by, the CTA.
 4. Solid Safety Barriers:
 - a. The Contractor shall build and maintain a solid barrier on a daily basis if the work creates a safety hazard for the public. This barrier should be 8 feet high minimum.
 - b. The barrier shall be removed upon completion of the Work or as directed by the CTA.
 - c. Barriers will be required to block off any closed portion of the platform. They shall be removed at the end of the work shift to allow for full platform access.
 5. Constructing Temporary Enclosures and Structures on Station Platforms:
 - a. Solid enclosures for temporary storage or work area separation shall be constructed of fire retardant material (such as wood treated with fire retardant chemicals etc.). Enclosures constructed of metal shall be properly grounded. Dust shields shall be provided if the enclosure is being used for demolition work. Applications for Enclosures/Structures must be requested of, and approved in writing by the CTA.
 - b. The height of the plywood/material of any enclosure/structure shall be not less than eight feet from the platform.
 - c. Doors shall not swing to the outside of enclosure(s) that are located in areas used by passengers.
 - d. Enclosures shall not create any cul-de-sac(s) (i.e., blind alley(s) or dead end(s)).
 6. Temporary Railings or Guardrails
 - a. Any temporary railings or guardrails used to protect platform openings shall meet all OSHA and building code requirements.
 - b. All temporary railings or guardrails shall be securely fastened to the platform to prevent falling over from adjacent passenger activity. They shall be secured such that they cannot be removed except by Contractor personnel.
 - c. If, in the opinion of IDOT or CTA, the railings are insufficient to prevent the potential for public injury, the Contractor shall be required to provide

a continuous guard to prevent any person from tampering with the railings.

3.04 SIGNAGE

- A. All signage shall comply with OSHA, MUTCD, IDOT, City of Chicago and CTA requirements.
- B. All signage shall conform with Technical Specification 10 42 60.
- C. Signage shall include the following at a minimum. Additional signage may be required at no additional cost to the contract based upon the actual work areas requested by the Contractor.
 - 1. Warning / Construction Area: Place signs on the platform every 25 feet within an active work area if also being used by the public.
 - 2. Platform Closed / Do Not Enter / Authorized Personnel Only: Locate signs on all barricades closing off the platform.
 - 3. Peoria Entrance Closed / Use Morgan or Halsted Entrance: Locate sign at base of Peoria east main stair and east exit only stair on construction barrier. Locate signs at main Peoria entrance when the bridge is reopened to pedestrian traffic but the station is not complete.
 - 4. Morgan Entrance Closed / Use Halsted Entrance: Locate signs along the open area of the platform every 25 feet. Two signs shall be used per location with each sign facing out towards the train loading.

3.05 TEMPORARY LIGHTING

- A. Temporary lighting is required in all platform or other public access areas where the permanent lighting has been removed or disabled for construction purposes.
- B. Prior to removal of existing lighting, Contractor shall benchmark the current lighting levels via a light meter at each fixture, mid-points between fixtures, and at a spacing not to exceed 20 feet.
- C. Contractor shall provide temporary lighting that will meet or exceed the benchmarked illumination levels.
 - 1. If benchmarking is not performed, the provided illumination will be 10 footcandles minimum at all locations within the area of temporary lighting.
- D. Lighting shall be installed in a secure manner in locations that are not easily accessible to the public.
- E. Lighting shall be installed as down light. No light shall project down the tracks or out towards the right-of-way in any indirect or direct manner that could affect the vision of the train operators or directly shine out onto the IDOT roadway.

3.06 RESTORATION

- A. All existing areas shall be fully restored to original condition, or better, at the completion of the contract.

END OF SECTION 02 10 00

SECTION 02 15 00
TEMPORARY SHORING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this section.

1.02 SUMMARY

- A. This section specifies requirements for temporary shoring of existing rapid transit structure at the Peoria Street Station, during demolition and construction operations. The work under this section shall include all labor, material, tools and equipment required to provide and install temporary support for the structure to facilitate removal, relocation, repair, additional new structure and related work as shown on the drawings, specified herein and directed by the Engineer.

1. Areas where Temporary Shoring is required:

- a. East Edge of Station
- b. East Exit Stair from Station
- c. Platform Edge at Elevator Pit
- d. Canopy Columns at Removal Area
- e. Platform Concrete Beams at Elevator Pit

- B. Related Sections: The following sections contain requirements that relate to this Section.

1. Section 02 05 00 – Demolition
2. Section 05 10 30 – Structural Steel

1.03 SUBMITTALS

- A. Design Calculations: Provide design calculations for Engineer's review. Provide six sets of calculations for the design of the temporary shoring structures. The calculations shall be signed and sealed by an Illinois licensed Structural Engineer.
- B. Shop Drawings: Prior to fabrication of temporary shoring, the Contractor shall submit shop drawings for structural steel shoring fabrication and erection prepared by a qualified steel detailer. The shop drawings shall indicate all connections, lengths, location of field and shop splices, attachments, erection and fabrication plans, and types of steel used. The Contractor shall design all shoring and show details of support beams, diaphragms, stiffeners, bracing, jacking blocks, etc. and all necessary connections. The shop drawings shall also include the Contractor's proposed staging or procedure for execution of shoring. The Contractor shall review all shop drawings and verify all dimensions and procedures. The Contractor shall submit shop drawings, signed and sealed by an Illinois licensed Structural Engineer to the Engineer for the Engineer's review and to the City of Chicago Office of Underground Coordination (OUC) for approval. Fabrication shall not commence until approval is received from the Engineer. The Engineer's approval of the shop drawings in no way shall relieve the Contractor of responsibility for erection means and methods, fabrication and fit in the field. The Contractor shall secure OUC approval prior to the start of any fabrication or field work.
- C. Provide a layout showing locations for shoring as required by the demolition and new construction work for this project. Indicate all field-verified dimensions and conditions that affect the shoring operations.

- D. Provide a Construction Process Plan outlining the installation and removal of the Temporary Shoring.

1.04 DEFINITIONS

- A. Temporary shoring shall include furnishing all steel, cribbing, leveling screenings, grading and erection.

1.05 STANDARDS

- A. All materials, design, fabrication, inspection, testing and erection procedures shall conform to the applicable provisions of the following codes, except as modified herein.
 - 1. IDOT Standard Specification and Bridge Construction, adopted July 1, Sections 505, 507, 509, 510, 710, 711, and 712, including the current Supplemental Specifications for these sections.
 - 2. American Railway Engineering Association (AREMA) "Manual for Railway Engineering", Chapter 15, "Steel Structures" current issue, parts 1, 3, and 4 and parts 1 and 3 of Chapter 7 "Timber Structures", current issue.
 - 3. City of Chicago Department of Transportation, Office of Underground Coordination (OUC).
 - 4. Chicago Building Code.
- B. CTA Structural and Rail Operations requirements:
 - 1. All column shoring must be designed to accommodate 35 mph train traffic.
 - 2. Contractor cannot replace foundations on adjacent columns at the same time.
 - 3. Contractor must stage the column work such that required slow zones comply with the requirements outlined in Division 1.

1.06 INSPECTION

- A. All material and workmanship shall be subject to inspection by the Engineer

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials and fabricated items shall be furnished by an established and reputable manufacturer or supplier.
- B. All structural steel used for shoring shall comply with requirements of ASTM A 36/A 36M. Bolts, nuts and washers shall conform to ASTM A325.
- C. Untreated timber shall be as specified in Section 06100 of these these specifications.
- D. Screenings used for leveling shall be CA-6 Gradation conforming to the requirements of Section 704 of IDOT Standard Specifications.

PART 3 EXECUTION

3.01 PREPARATION

- A. The Contractor shall establish and locate all lines and levels and be responsible for correct locations of all shoring.
- B. The Contractor shall verify the location of utilities or structures affected by the shoring. Any disturbance or damage to existing structures or other property, caused by the Contractor's operations shall be repaired by the Contractor in a manner satisfactory to the Engineer, at no additional cost to the CTA.
- C. The Contractor shall verify the support base of sufficient soil capacity for the proposed shoring.
- D. Connections to existing columns and beams shall be bolted and shall incorporate existing rivet holes if possible. Rivets shall be removed by a process which will not damage nor weaken the column or beam nor damage nor enlarge the existing holes.

3.02 STEEL FABRICATION

- A. Structural steel shall be fabricated in accordance with Section 051030, Structural Steel.

3.03 ASSEMBLY AND ERECTION

- A. Structural steel shall be assembled and erected in accordance with Section 051030, Structural Steel, also in accordance with Part 4, Erection, Chapter 15 of the AREMA Manual. Where differences occur in the provisions of the Standard Specification and the AREMA Manual, the more stringent requirement shall be followed, as determined by the Engineer. Field welds other than those shown on the drawings are prohibited unless specifically authorized by the Engineer.
- B. Timber shall be assembled and erected in accordance with Chapter 7 of the AREMA Manual.
- C. The sequence of work shall follow that outlined in the Drawings. Any deviations shall be made only with the prior approval of the Engineer.

3.04 HYDRAULIC JACKS

- A. If used, the hydraulic jacking system shall be equipped with check valves and shut-off valves to isolate individual rams. The system shall also be equipped with hydraulic pressure gauges to monitor line pressures.
- B. No live loads shall be allowed to pass over the structure while it is supported by the hydraulic jacking system.
- C. Jacking under live track shall be done under flag protection ONLY.

3.05 PROTECTION

- A. The Contractor shall be responsible for protecting and maintaining any existing shoring of the elevated structure and platform which is affected by his shoring operations and to prevent his own shoring from disturbance by traffic and construction.

END OF SECTION 02 15 00

SECTION 02 25 80
MICROPILES

PART 1 GENERAL

1.01 SUMMARY

- A. Design, furnish, install, and test micropiles as shown on the contract plans and approved working drawings and as specified herein. Furnish all design, materials, products, accessories, tools, equipment, services, transportation, labor and supervision, and manufacturing techniques required for design, installation and testing of micropiles and pile top attachments for this project.
- B. Related Sections:
 - 1. Section 02150: Temporary Shoring
 - 2. Section 03200: Concrete Reinforcement Galvanized
 - 3. Section 03300: Cast-in-Place Concrete

1.02 DESIGN

- A. The Plans indicate micropile locations, typical details, bearing stratum and loads. The micropile layout and details indicated on the Plans are intended to depict the major components and extent of the work and is not intended to be complete in every detail. The Contractor may, after bid, propose revisions to the micropile system shown. If the alternative proposed is not found acceptable by the Department, the Contractor must submit a system which is acceptable to the Department.
- B. The micropiles must be designed by the micropile Contractor to meet the specified loading conditions, as shown on the Plans and the approved working drawings. Design the micropiles and pile top to mat foundation, pile cap or temporary steel beam connections using the procedures contained in the FHWA "Micropile Design and Construction Guidelines Manual", Report No. FHWA-SA-97-070. Use existing geotechnical data as described in Section 1.05 and exploratory boring data as required in Section 3.01 for design. Design calculations and drawings must be sealed by a Licensed Structural Engineer in the State of Illinois.
- C. In any event, the Contractor will be completely responsible for the design and subsequent construction of the micropiles as indicated on the Plans and as approved by the Department. The design of the micropiles must be prepared under the direct supervision of a Licensed Structural Engineer in the State of Illinois.

1.03 REFERENCES

- A. Applicable Standards: The publications and references listed below form a part of the Contract unless noted otherwise. Except as specifically modified by the requirements specified herein or the details of the drawings, the Work included under this Section must conform to the provisions of these publications.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A82: "Specification for Steel Wire, Plain, for Concrete Reinforcement."
 - 2. ASTM A252: "Specification of Welded and Seamless Steel Pipe Piles."
 - 3. ASTM A 615: "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement"

4. ASTM A 722: "Specification for Uncoated High Strength Steel Bars for Prestressed Concrete."
 5. ASTM A 775: "Specification for Epoxy-Coated Steel Reinforcing Bars."
 6. ASTM A 934: "Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars."
 7. ASTM C 33: "Concrete Aggregates."
 8. ASTM C 109: "Test Method for Compressive Strength of Hydraulic Cement Mortars."
 9. ASTM C 144: "Aggregate for Masonry Mortar."
 10. ASTM C 150: "Specification for Portland Cement."
 11. ASTM C 188: "Test Method for Density of Hydraulic Cement."
 12. ASTM C 494: "Chemical Admixtures for Concrete."
 13. ASTM D 1143: "Test Methods for Deep Foundations Under Static Axial Compressive Load."
 14. ASTM D 1784: "Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds"
- C. American Welding Society (AWS):
1. AWS D 1.1: "Structural Welding Code."
 2. AWS D: "Structural Welding Code- Reinforcing Steel."
- D. Post-Tensioning Institute (PTI):
1. PTI: "Recommendation for Prestressed Rock and Soil Anchors."
- E. Federal Highway Administration (FHWA):
1. FHWA-SA-97-070: "Micropile Design and Construction Guidelines."
- F. American Petroleum Institute (API)
1. API 5CT (N-80): "Specification for Casing and Tubing."
 2. API RP 13B-I: "Recommended Practice-Standard Procedure for Field Testing of Water Based Drilling Fluids."
- G. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, Adopted January 1, 2012.
- H. AREMA, Manual for Railway Engineering, 2013.

1.04 SUBMITTALS

- A. Submittals: Make submittals to Department, for review and release. Review and release of submittals does not relieve the Contractor of any of the responsibilities and requirements of this Section, and the design drawings. Department's review must be made to verify that the general scope of work is adequate. Review of the Contractor's plans and methods of construction will not be construed to relieve the Contractor, in any way, of his responsibility for the successful performance of the work.
1. Working drawings, calculations and a design submission thoroughly describing each micropile size and capacity intended for use. Drawings must include plan, details, dimensions, quantities, ground profiles, and cross-sections necessary to construct the micropile structure. Include results of exploratory borings. The calculations must be prepared and sealed by a Licensed Structural Engineer in the State of Illinois.

2. Manufacturer's Certificate of Compliance: Certification that products supplied meet or exceed specified requirement.
3. A list identifying the Engineer and on-site supervisors who will be assigned to the project. The list must contain a summary of each individual's experience, and it must be complete enough for the Department to determine whether or not each individual has satisfied the experience requirements.
4. Work Plan including a detailed description of the work schedule, drilling methods, micropile installation and connection methods, and grout mixing and injection procedures.
5. Grout mix design.
6. Setup and procedure for pile load tests.
7. Pile load test reports.
8. Micropile installation records for each micropile installed.

1.05 EXISTING CONDITIONS

- A. Existing site geotechnical conditions have been investigated and logs have been prepared by the following Consultant:
 1. Wang Engineering, Inc.
 - a. SGR for Peoria Street Bridge dated July 24, 2013
 - b. Technical Memorandum for Micropiles dated 8/23/2013
- B. The information contained in the logs/reports identified in Article 1.05.A. above, shall not be used as a guarantee of depth, extent, or character of materials actually present.
- C. Existing utilities and structures are located on the construction site. Care must be taken not to damage those utilities or structures, or to disrupt service of same.
- D. The Contractor is alerted that because of the urban setting and the presence of existing fill soils, obstructions to drilling may be present.
- E. The Contractor must immediately notify the Department if conditions vary from those indicated.

1.06 QUALITY ASSURANCE

- A. The micropile Contractor must be a specialty contractor having experience acceptable to the Department in the design, installation, and load testing of micropiles.
- B. The micropile Contractor must have on his staff, and assigned to this project an engineer to supervise the work with experience acceptable to the Department on successfully completed micropile projects of similar scope. Use of a consultant or manufacturer's representative will not meet the requirements for a supervising engineer. In addition, the Contractor must have, on his staff and assigned to this project, a superintendent or foreman and drill rig operators with experience acceptable to the Department in similar micropile construction.
- C. The micropiles must be designed by a Licensed Structural Engineer in the State of Illinois with experience acceptable to the Department in the design of successfully completed micropile projects of similar scope. The micropile designer may be either an employee of the Contractor or a separate Consultant designer meeting the stated experience requirements.
 1. Inadequate proof of the qualifications representative will not meet the requirements for a staff or design engineer.

2. Inadequate proof of the qualifications, as judged by the Department, will be cause for rejection of the proposed micropile Contractor.
- D. The Department reserves the right to suspend the work if the Contractor substitutes unqualified personnel for approved personnel during construction. If work is suspended due to the substitution of unqualified personnel, the Contractor must be fully liable for additional costs resulting from the suspension of work and no adjustment in contract time resulting from the suspension of work will be allowed.
- E. The construction of the new station project is during a limited period, and the design and installation of the micropiles must be completed in this period. The Contractor must coordinate the design and schedule requirements and constraints for the micropiles with the micropile Contractor and the other Contractors involved in the construction of the subway renovation project, such as the demolition Subcontract, the excavation Contractor, the jet grouting Contractor and the concrete construction Contractor.
- F. Site Conditions: Before bidding the work, review the available subsurface information, review the plans and sequence of work, and visit the site to assess the site geometry, equipment access conditions, and location of existing structures.
- G. There will be a pre job meeting held at the site with the Contractor, his micropile, and other Contractors, and the Department, to review the requirements, specifications, design, procedures, and equipment to be used for the installation of the earth retention walls. No micropiles will be installed without the Department's approval of the design, installation methods, and equipment.
- H. All welding must be performed using written procedures qualified in accordance with Section 5, Parts A and B of A WS DI. 1.
 1. All welders must be qualified by test, using the welding process to be utilized, before doing any production welding. Qualifications of welders must be conducted in accordance with AWS DI. 1, Section 5, Part c.
- I. The Contractor must comply with all applicable codes, laws, ordinances and regulations of governmental authorities having jurisdiction over the demolition work including applicable OSHA and Standard Specifications requirements.
- J. The Contractor must verify all existing conditions and dimensions in the field.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Admixtures: Conform to ASTM C494. Admixtures that control bleed, improve flowability, reduce water content, and retard set may be used in the grout, subject to the review and acceptance of the Department. Use in accordance with manufacturer's recommendations. Only add expansive admixtures to the grout used for filling sealed encapsulations and anchorage covers. Accelerators are not permitted. Admixtures containing chlorides are not permitted.
- B. Cement: Portland cement conforming to ASTM C 150 Types II, III, or V.
- C. Centralizers and Spacers: Fabricate from schedule 40 PVC pipe or tube, steel or material non-detrimental to the reinforcing steel. Do not use wood.

- D. Grout: Neat cement or sand/cement mixture with a minimum 3-day compressive strength of 2000 psi and a 28-day compressive strength of 4000 psi per ASTM C 1 09.
- E. Permanent Casing Pipe: Provide the diameter and minimum wall thickness shown on the working drawings. Meet the Tensile Requirements of ASTM A252, Grade 3, except use a minimum yield strength of 80 ksi. May be new "Structural Grade" (a.k.a. "Mill Secondary") steel pipe meeting above but without Mill Certification, free from defects (dents, cracks, tears) and with two coupon tests per truckload delivered to the fabricator.
- F. Plates and Shapes: Conform to ASTM A36 or ASTM A 572, Grade 350.
- G. Galvanized Reinforcing Bars: Deformed bars in accordance with ASTM A615, Grade 420 or Grade 520 or ASTM A 722 Grade 1035. If required, use bar tendon couplers that develop the ultimate tensile strength of the bars without evidence of any failure.
- H. Water: Use water in the grout mix that is potable, clean, and free from substances that may be injurious to cement and steel.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify site location and conditions prior to the execution of work.
- B. Perform a minimum of two exploratory core borings to verify elevation and condition of dense loam material. Drill core borings in accordance with ASTM D2113 to a depth of at least 20 feet into dense loam. Log core borings.
- C. Protect existing nearby structures and utilities from any possible damage that may result from the work that is to be performed.
- D. Perform initial excavation work to the elevations shown on the drawings.

3.02 INSTALLATION OF MICROPILES

- A. The micropile Contractor must select the drilling method, the grouting procedure, and the grouting pressure used for the installation of the micropiles as well as the micropile casing size, final drillhole diameter and bond length, and central tendon reinforcement steel sizing necessary to develop the specified load capacities and load testing requirements. The micropile Contractor is also responsible for estimating the grout take. There will be no extra payment for grout overruns.

- B. Meet the following construction tolerances:
1. Centerline of piling not more than 3 inches from indicated plan location
 2. Plumb within 2 percent of total-length plan alignment.
 3. Top elevation of pile plus 1 inch or minus 2 inches maximum from vertical elevation indicated.
 4. Centerline of reinforcing steel not more than 0.6 inches from indicated location.
- C. The micropile Contractor is responsible for maintaining an open hole. Use of drilling fluid containing bentonite is not allowed.
- D. Contractor to determine bottom of micropile elevation at each foundation to obtain allowable design pressure as shown on plans.
- E. Grout strength and mix requirements must be determined by the Contractor.
- F. Primary grout micropiles the same day the load transfer bond length is drilled. Use grouting equipment that produces grout free of lumps and undispersed cement and is sized to enable each pile to be grouted in one continuous operation. Place grout within one hour of mixing.
- G. Provide means and methods of measuring the grout quantity and pumping pressure during the grouting operations. Equip the grout pump with a pressure gauge to monitor grout pressures. Place a second pressure gauge at the point of injection at the pile top. The pressure gauges shall be capable of measuring pressures of at least 150 psi or twice the actual grout pressures used, whichever is greater.
- H. Inject the grout from the lowest point of the drill hole and continue until uncontaminated grout flows from the top of the pile. Extract temporary casing, if used in stages ensuring that, after each length of casing is removed the grout level is brought back up to ground level before the next length is removed. The tremie pipe or casing must always extend below the level of the existing grout in the drill hole. Control grout pressures and grout takes to prevent excessive heave or fracturing of rock or soil formations. Upon completion of grouting, the grout tube may remain in the hole, but must be filled with grout.
- I. If post grouting is used, submit working drawings and details for review in accordance with Section 1.04.

3.03 LOAD TESTS

- A. Perform a load test for one pile at each location where micropiles are installed. Load test piles to twice the design load shown on the Drawings. The load test will be evaluated by the Contractor and the Department for compliance with job performance requirements.
- B. Perform load test in accordance with ASTM D 1143 and as specified herein.
- C. Incrementally load the test micropile in accordance with the following load schedule:

AL = Alignment DL = Design Load = 108 kips		
	LOAD	HOLD TIME
1	AL (0.05 DL)	1 minute
2	0.25 DL	1 minute
3	0.5 DL	1 minute
4	AL	1 minute
5	0.25 DL	1 minute
6	0.5 DL	1 minute

7	0.75 DL	1 minute
8	AL	1 minute
9	0.25 DL	1 minute
10	0.5 DL	1 minute
11	0.75 DL	1 minute
12	1.00 DL	1 minute
13	AL	1 minute
14	0.25 DL	1 minute
15	0.5 DL	1 minute
16	0.75 DL	1 minute
17	1.00 DL	1 minute
18	1.33 DL	60 minutes (Creep Test Hold)
19	1.75 DL	1 minute
20	2.00 DL (Maximum Test Load)	10 minutes
21	AL	1 minute

- D. If the test piles successfully pass the tests, they may be incorporated into permanent load carrying structures.
- E. Do not exceed a vertical settlement tolerance of 1 inch at the vertical design load.
- F. If the load tests fail to give acceptable results, the micropile Contractor must modify the design and install and test other piles at no additional cost.
- G. Strictly replicate all installation methods including drilling methods, grout injection procedures, used in installing the successful test pile in the installation of all production piles.

END OF SECTION 02 25 80

SECTION 02 45 00
CAISSONS

Refer to Section 516 of the IDOT Standard Specifications for Road and Bridge Construction, Adopted January 1, 2012.

END OF SECTION 02 45 00

SECTION 02 61 00
CONTAMINATED SOIL REMOVAL AND DISPOSAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes but is not limited to the following:
1. Removal, handling and disposal of contaminated soil at all locations to be excavated as a part of this project.
- B. Related Sections: The following sections contain requirements that relate to this section.
1. Division 03 Section, Concrete.
 2. Division 31 Section, Earthwork

1.03 SUMMARY OF WORK

- A. The Contractor shall remove the existing concrete required to be removed to accommodate the work.
- B. Unless the Contractor determines by sampling and tests performed by an approved independent testing agency that the material to be excavated is not contaminated and is not special waste, the material excavated in this area should be assumed as contaminated and shall be treated as special waste. Certified copies of the tests must be submitted to the Department for approval.
- C. This work is not intended to fully remediate the contaminated soil; rather it is only intended to remove the soil necessary to accommodate the repair of the bus hoist pits.
- D. The Contractor shall notify the Department if contaminated soil exceeds the limits of the required excavation. If the area of contaminated soil exceeds the limits of the required excavation, the Contractor shall line the excavation with a 10 mil liner to prevent the migration of additional contaminated soil into the newly excavated area.
- E. The Contractor shall identify an acceptable licensed Type II landfill for contaminated soil disposal. The Contractor shall also obtain the waste disposal approval, which will likely include collecting and analyzing a soil sample(s) for waste characterization with parameters requested from the landfill.
1. Landfill must be on the list of the Department's approved landfill facilities.
- F. The contaminated soil will be transported and disposed as non-hazardous waste in an accepting Type II landfill approved by the Department.
- G. The fate of each load of contaminated soil will be documented using soil disposal manifest forms, typically provided by the landfill.
- H. The excavation will be backfilled with compacted granular fill as specified in Section 31 20 00, Earthwork and as approved by the Department.

1.04 SUBMITTALS

- A. If the material to be excavated is sampled and tested to determine if it is contaminated and special waste, the Contractor shall submit the certified test reports to the Department for review and approval.
- B. Contractor to submit a Health and Safety Plan to perform the contaminated soil removal and disposal work to the Department prior to beginning the work.
- C. Contractor to submit Certificates of Health and Safety Training as mandated by OSHA for all personnel that will be working on the site to the Department prior to beginning the work.
- D. Contractor to submit copies of any required permits to perform the contaminated soil removal and disposal work to the Department prior to beginning the work.
- E. Contractor to submit landfill approval documentation (including additional laboratory test results, if necessary) for the disposal of the contaminated soil to the Department prior to removing and disposing of the contaminated soil.
- F. Contractor to submit soil disposal manifests to the Department when completed.
- G. Contractor to submit a site plan of proposed areas for stock piled excavated material to be approved by the Department.
- H. The Contractor shall submit for the Department's review and approval a work schedule and work plan prior to beginning the work.

1.05 SEQUENCE OF WORK

- A. The Contractor shall prepare a site specific health and safety plan in compliance with applicable regulations.
- B. The Contractor shall identify the licensed Type II landfill able to accept the contaminated soil and approved by the Department.
- C. The Contractor shall obtain landfill disposal approval, including any necessary testing requirements mandated by the landfill, including prior soil testing results.
- D. The Contractor shall place appropriate barricading around the work area for access control.
- E. The contaminated soil shall be (1) direct loaded for immediate transport and disposal to the landfill, (2) placed in plastic lined roll-off boxes for later disposal, or (3) stockpiled and covered with plastic for later disposal by the Contractor. If the contaminated soil is staged for later disposal, effort should be made to diligently remove and transport the contaminated soil to the landfill.
- F. All contaminated soil removed from the site shall be properly manifested with a copy of the completed manifest submitted to the Department.

1.06 QUALITY ASSURANCE

- A. All work shall be done in full compliance with all applicable federal, state and local codes and regulations and OSHA and EPA requirements.
- B. Follow all applicable regulations, codes and ordinances when removing, transporting and disposing of contaminated subgrade materials.

1.07 PROJECT CONDITIONS

- A. Site Information: Verify existing conditions and dimensions in the field prior to beginning the work.
- B. Coordination: Coordinate the contaminated soil removal and disposal work of this section with the excavation work, concrete repair work and other related work to be performed for this project.
- C. Structural stability of the excavation and existing structures are the responsibility of the Contractor. Provide shoring or other means to achieve stability as required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Barricading and/or fencing as appropriate, for access control.
- B. Minimum 6-mil plastic to cover stockpiled soil and/or to line and cover roll-off boxes, if applicable.

PART 3 EXECUTION

3.01 LANDFILL IDENTIFICATION AND APPROVAL

- A. The Contractor will identify an acceptable licensed Type II landfill for contaminated soil disposal.
- B. The Contractor will obtain the waste disposal approval, which will likely include collecting and analyzing a soil sample(s) for waste characterization with parameters requested from the landfill. This documentation will also likely require the Department's signature as the Generator of the waste.

3.02 ACCESS CONTROL

- A. Contractor to install and maintain barricading and/or fencing and take other measures to prevent individuals from entering the area during the contaminated soil removal.

3.03 CONTAMINATED SOIL REMOVAL TRANSPORT AND DISPOSAL

- A. The contaminated soil shall be (1) direct loaded for immediate transport and disposal to the landfill, (2) placed in plastic-lined roll-off boxes for later disposal, or (3) stockpiled and covered with plastic for later disposal by the Contractor.
- B. The contaminated soil shall be transported and disposed as non-hazardous waste to the Type II landfill.

- C. All contaminated soil removed from the site will be properly manifested, with a copy provided to the Department. The manifests should be fully executed with signatures from the generator (or designated representative), transporter and disposal facility.

3.04 SPILLS AND LEAKS

- A. Spills of fuel, oil, petroleum liquids and other contaminating materials resulting from fueling operations or damaged hydraulic lines, or otherwise created by the Contractor's activities are the responsibility of the Contractor. Contaminating substances entering the solid and/or surface water must be immediately cleaned up. All associated costs to be borne by the Contractor.

3.05 REMOVAL AND DISPOSAL OF CONTAMINATED SOIL

- A. All work shall be done in full conformance with federal, state and local regulations.
 - 1. Neither the presence nor oversight of work by employees of the Department shall create any obligation on the Department to monitor the health or safety of the Contractor's employee's or general jobsite safety. The Contractor shall be solely responsible for maintaining the safety of the jobsite, and ensuring that visitors, its workers and others are protected.
 - 2. The Contractor shall maintain insurance in accordance with the stated requirements for the duration of the project.
 - 3. The Contractor shall submit for the Department's review and approval a work schedule and work plan prior to beginning the work.
 - 4. Unless specifically stated otherwise, all work shall be performed by the Contractor, or an approved Subcontractor working under the Contractor's contract.

END OF SECTION 02 61 00

SECTION 03 01 30
MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes concrete repair including repair of spalled or missing concrete and voids using concrete repair mortar; repair of cracks in concrete.
- B. Spalls, Missing Concrete: Concrete repair work of spalled or missing concrete includes:
 - 1. Exposing and undercutting reinforcing steel.
 - 2. Repairing, cleaning, and treating reinforcing steel.
 - 3. Edge and surface conditioning of concrete area to be patched.
 - 4. Application of bonding agent.
 - 5. Application of concrete repair mortar.
 - 6. Finishing of concrete patch to match adjoining surfaces.
- C. Cracks: Concrete crack repair work includes:
 - 1. Cleaning surface of cracked concrete.
 - 2. Application of gravity penetrating crack sealer to repair hairline surface cracks.
 - 3. Epoxy pressure injection of cracks to repair cracks.

1.02 REFERENCES

- A. American Society For Testing and Materials (ASTM).
 - 1. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) coatings on Iron and Steel Products.
 - 2. ASTM A 767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - 3. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot- Dip Galvanized Coatings.
- B. American Concrete Institute (ACI)
 - 1. ACI 301 – Standard Specification for Structural Concrete.
 - 2. ACI 315 – Details and Detailing of Concrete Reinforcement.
 - 3. ACI 318 – Building Code Requirements for Structural Concrete.
 - 4. ACI SP-66 – ACI Detailing Manual.
- C. Concrete Reinforcing Steel Institute (CRSI)
 - 1. Manual of Standard Practice.

1.03 SUBMITTALS

- A. Product Data: Submit product data for proprietary materials and items, including patching materials and forming accessories, bonding compounds, curing and coating compounds.
- B. Repair Procedures: Submit repair mortar manufacturer's narrative description of procedures and methods for removal of concrete, repairing and cleaning of reinforcing steel, and applying new repair mortar and coatings.

- C. Statement of Application: Provide statement, signed by authorized representative of patching materials manufacturer, that manufacturer has reviewed contract documents and project conditions relating to concrete repair and that manufacturer's materials proposed for use are suitable for the applications indicated.
- D. Certification: Submit manufacturer's certification that products provided comply with specified requirements.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have not less than 5 years successful experience providing concrete repairs similar in size and complexity to that required for this project, and shall be approved by the repair material manufacturer.
- B. Standards: Comply with provisions of the following Codes and Standards, except where more stringent requirements are shown or specified:
 - 1. ACI 318, "Building Code Requirements for Reinforced Concrete:", latest edition.
 - 2. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice", latest edition.
- C. Testing: The Owner may engage a testing laboratory to perform material evaluation tests.
 - 1. Materials and installed work may require testing and re-testing at any time during progress of the work. Re-testing of rejected materials for installed work, shall be done at the Contractor's expense.
- D. Preparation Field Sample: Provide a field sample of concrete prepared for application of repair mortar, including undercutting and preparation of reinforcing steel, for Architect's review prior to proceeding with coating. Sample shall be an area approximately 1'-0" x 1'-0". Locate as determined by the Architect.
- E. Concrete Mortar Repair Field Sample: Provide an in-place field sample installation of one mortar patch area of spalled concrete for Architect's review prior to proceeding with repairs. Install field sample at final approved preparation sample specified above, in the presence of the Architect.

1.05 PROJECT CONDITIONS

- A. Environmental Conditions: Perform concrete repairs only when weather and forecasted weather conditions comply with requirements of repair material manufacturer.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Concrete: Plywood panel materials, to provide continuous, straight, smooth, exposed surfaces.
 - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.
 - 2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

2.02 REINFORCING MATERIALS

- A. Replacement Reinforcing Bars: ASTM A 615, Grade 60 deformed, hot dip galvanized.
- B. Supports for Reinforcement: Provide supports for replacement reinforcement as necessary including wire ties and spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Metal supports to be hot dip galvanized.

2.03 REPAIR MATERIALS

- A. Bonding Agent: Multi-component, solvent-free, moisture-tolerant epoxy-modified cementitious product formulated as a bonding agent and anti-corrosion coating.
 - 1. Corrosion Inhibition: Material shall have been proven by independent laboratory testing to prevent corrosion of reinforcing steel when tested under procedures of the Federal Highway Administration Program Report FHWA/RD88/193.
 - 2. Bond Strength:
 - a. Plastic Concrete to Hardened Concrete: Wet on Wet: 2800 psi min., 14 days moist cure, per ASTM C 882.
 - b. Steel Reinforcement to Concrete: 625 psi min., pullout test.
 - 3. Product:
 - a. Provide Sika Armatec 110 EpoCem; Sika Corp.
 - b. Provide Sto Epoxy Adhesive; Sto Concrete Restoration Division.
- B. Repair Mortar: Silica fume polymer-modified portland cement mortar intended for use as a patching mortar at thicknesses of 1/2" and greater, freeze-thaw resistant, compatible with coefficient of thermal expansion of concrete.
 - 1. Flowable Mortar:
 - a. Bond Strength: 2200 psi at 28 days, per ASTM C 882 modified.
 - b. Flexural Strength: 720 psi min at 28 days, per ASTM C 293.
 - c. Splitting Tensile Strength: 500 psi min. at 28 days, per ASTM C 496.
 - d. Compressive Strength: 3000 psi at 1 day, 6500 psi at 28 days, per ASTM C 109.
 - e. Product:
 - 1) Provide SikaTop 111 Plus; Sika Corp.
 - 2) Provide Sto Flowable Mortar; Sto Concrete Restoration Division.
 - 2. Non-Sag Mortar:
 - a. Bond Strength: 1000 psi at 28 days, per ASTM C-882 modified.
 - b. Flexural Strength: 1000 psi min at 28 days, per ASTM C-293.
 - c. Splitting Tensile Strength: 400 psi min. at 28 days, per ASTM C-496.
 - d. Compressive Strength: 1500 psi at 1 day, 4300 psi at 28 days, per ASTM C-109.
 - e. Product:
 - 1) Provide SikaTop 123 Plus; Sika Corp.
 - 2) Provide Sto Trowel Grade Mortar; Sto Concrete Restoration Division
- C. Penetrating Crack Sealer: Two-component 100% solids epoxy crack penetrating sealer; conforming to ASTM C 881.

1. Products:
 - a. Provide Sikadur 55SLV Healer/Sealer; Sika Corporation
 - b. Provide Sto Flexible Crack Sealer; Sto Concrete Restoration Division

D. Pressure Injection Crack Repair: Two-component 100% solids epoxy crack repair; cap sealer and pressure injection epoxy conforming to ASTM C 881.

1. Products:
 - a. Provide Cap sealer: Sikadur 33; and Injection epoxy: Sikadur Injection Gel; Sika Corporation
 - b. Provide Cap sealer: Sto Quick Set Epoxy Gel; and Injection epoxy: Sto Epoxy Binder; Sto Concrete Restoration Division

E. Water: Drinkable.

2.04 MIXING

- A. Mix repair materials in accordance with manufacturer's instructions. Mix multi-component products using equipment recommended by manufacturer. Only mix quantities which can be used within its pot life.

PART 3 EXECUTION

3.01 GENERAL

- A. Coordinate the work required for the removal of the loose and delaminated concrete, the repair and cleaning of the exposed reinforcing steel, the placement of forms, and the placement of repair mortar to minimize the time that reinforcing steel is exposed.

3.02 CONCRETE SURFACE PREPARATION

- A. Remove delaminated concrete and remove additional concrete as required to provide minimum required thickness of repair material.
- B. Edge Preparation: Make a minimum 1/2" deep sawcut along perimeter of repair areas. Make cut at right angle to surface. Avoid feather edges. Geometric configurations or repair patches shall be kept as simple as possible.
- C. After removals and edge conditioning are complete, remove bond inhibiting materials (dirt, concrete slurry, loosely bonded aggregates) by abrasive blasting or high pressure waterblasting with or without abrasive. Check the surfaces after cleaning to insure that surface is free from additional loose aggregate, or that additional delaminations are not present.
- D. If hydro demolition is used, cement and particulate slurry must be removed from the prepared surfaces before slurry hardens.

3.03 EXPOSING AND UNDERCUTTING REINFORCING STEEL

- A. Remove damaged or unsound concrete. Use concrete removal procedures which will not structurally weaken the surrounding precast concrete.
- B. Once initial concrete removal is made, undercut exposed oxidized (corroded) reinforcing.

Undercutting shall provide clearance for cleaning, full bar circumference bonding to surrounding concrete, and securing the patch structurally.

- C. Provide minimum 3/4" clearance between exposed rebars and surrounding concrete or 1/4" larger than largest aggregate in repair mortar, whichever is greater.
- D. Concrete removals shall extend along the bars to locations along the bar free of bond inhibiting corrosion, and where the bar is well bonded to surrounding concrete.
- E. If unoxidized reinforcing steel is exposed during the undercutting process, care shall be taken not to damage the bar's bond to surrounding concrete. If bond between bar and concrete is broken, undercutting of the bar shall be required.
- F. Reinforcement which is loose shall be secured in place by tying to other secured bars or by other approved methods.
- G. Condition edges of repair area by making 1/2 in. sawcut along perimeter.

3.04 REPAIRING AND CLEANING OF REINFORCING STEEL

- A. After removal of concrete, notify Architect for inspection of steel reinforcing.
- B. If a reinforcing bar has lost more than 20% of its cross section, provide one of the following repair methods:
 - 1. Completely replace reinforcing, or
 - 2. Add supplemental reinforcing over the affected section. The new reinforcing bar may be mechanically spliced to the existing bar, or placed parallel to and approximately 3/4" from the existing bar. Lap length shall be in accordance with ACI 318.
- C. Remove heavy oxides and scale from the exposed reinforcing bars, as necessary to insure maximum bond of the replacement material.

3.05 APPLYING REPAIR MORTAR

- A. General: Perform repairs using flowable mortar or non-sag mortar as appropriate to conditions at each location.
- B. Forms:
 - 1. Support, brace, and maintain forms as required to support loads that might be applied. Construct formwork so concrete repair patch is of correct size, shape, and alignment.
 - 2. Construct forms of one piece and to obtain accurate alignment, location, grades, and plumb work in finished repair.
 - 3. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
 - 4. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive repair mortar. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Tighten forms and bracing before repair mortar placement to prevent mortar leaks and maintain alignment.
- C. Preparation of Form Surfaces:
 - 1. Coat contact surfaces of forms with a nonresidual, form-coating compound.
 - 2. Do not allow excess form-coating material to accumulate on forms or to come

into contact with existing concrete surfaces against which repair mortar will be placed. Apply in compliance with manufacturer's instructions.

- D. Repair Mortar Placement:
 - 1. Apply bonding compound to prepared concrete and reinforcing steel surfaces. Apply in compliance with manufacturer's instructions at coverage rate recommended for performance as a bonding agent and as a corrosion inhibitor.
 - 2. Deposit repair mortar continuously in a manner to avoid segregation at its final location and in accordance with manufacturer's instructions.
- E. Finish of Formed Surfaces: Provide an as-cast concrete surface to match the existing cast in place concrete surface, with a minimum of seams. Repair and patch defective areas including fins and other projections completely removed and smoothed. Match approved field sample.
- F. Curing and Protection: Protect freshly placed repair mortar from premature drying and excessive cold or hot temperatures.

3.06 PENETRATING CRACK SEALER APPLICATION

- A. Clean and prepare cracked concrete surfaces in accordance with sealer manufacturer's instructions. Concrete shall be clean, sound, and free of surface moisture, Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means.
- B. Apply penetrating crack sealer to cracked concrete surfaces, in accordance with manufacturer's instructions.

3.07 PPRESSURE INJECTION CRACK REPAIR

- A. Prepare concrete cracks in accordance with sealer manufacturer's instructions. Cracks and surface 1" on each side of crack shall be clean, sound, and free of surface water (may be damp but not wet). Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means from one inch on each side of crack. Blow cracks clean with oil free compressed air.
- B. Mix repair materials according to manufacturer's instructions.
- C. Install injection ports. Apply cap seal, trowel grade (non sag) epoxy, to the crack forcing epoxy around the ports and sealing the crack. Allow epoxy to cure before pressure injecting the crack.
- D. Pressure inject epoxy into ports to fill crack using pressure injection equipment recommended by epoxy manufacturer.

END OF SECTION 03 01 30

SECTION 03 20 00
CONCRETE REINFORCEMENT GALVANIZED

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this section.

1.02 SUMMARY

- A. The work under this Section shall consist of furnishing all labor, materials, and equipment required for furnishing, fabricating and placing reinforcement steel used in concrete slabs and structures, including bars, mesh, ties, supports, chairs, spacers, clips and all other appurtenant work. All reinforcing bars, mesh and accessories to be hot dip galvanized.
- B. Related Sections: The following sections contain requirements that relate to this Section.
1. Section 01 45 80 - Testing and Inspection Service
 2. Section 03 30 00 - Cast-In-Place Concrete
 3. Section 03 40 00 - Precast Structural Concrete

1.03 REFERENCES

- A. Except as modified herein, the work shall conform to the applicable portions of the Standard Specifications.
- B. American Society for Testing and Materials (ASTM)
1. ASTM A36 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Steel Piling.
 2. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 3. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) coatings on Iron and Steel Products.
 4. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 5. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 6. ASTM A385 – Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
 7. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 8. ASTM A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 9. ASTM A767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 10. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized coatings.
 11. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 12. ASTM A743 – Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Application.
 13. ASTM A384 – Practice for Safeguarding Against Warpage and Distortion during Hot Dip Galvanizing of Steel Assemblies.

14. ASTM B6 – Specification for Zinc.
15. ASTM E376 – Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.

C. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete.
2. ACI 315 - Details and Detailing of Concrete Reinforcement.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI SP-66 - ACI Detailing Manual.

D. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice.

E. American Welding Society (AWS)

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

F. Publications

1. American Galvanizers Association (AGA)
 - a. Galvanizing for Corrosion Protection: A Specifier's Guide to Reinforcing Steel.
 - b. The Design of Products to be Hot-Dip Galvanized After Fabrication.
 - c. The Inspection of Products Hot Dip Galvanized After Fabrication.
 - d. Recommended Details for Galvanized Structures.
2. American Welding Society
 - a. Welding Zinc Coated Steel – AWS D19.0-72.

- G. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

- A. Prior to performing the work, the Contractor shall submit to IDOT, in accordance with Section 01 30 00, a list of materials and product data for concrete reinforcement. Include all bars, mesh and accessories.
- B. Contractor shall submit shop drawings showing materials of construction and installation details and spacing for concrete reinforcement; for review and approval. Include all bars, mesh and accessories.
 1. Shop drawings for reinforcing shall be certified by galvanizer.
- C. The Contractor shall submit certified copies from the supplier indicating the grade of steel being furnished, and reports on mill tests for chemical analysis, tensile strength, and bend tests for reinforcing bars and welded wire fabric. The Contractor shall certify, in writing, that material supplied meets or exceeds specified requirements. Supplier of reinforcing to certify the grade of steel being supplied meets these requirements.
- D. Provide reinforcing steel placing drawings for each portion of the work. Show all splice locations and lap lengths. Show the placement of all required additional reinforcement such as around openings, at corners, etc. as shown on the drawings or as otherwise

required or recommended.

- E. Provide specifications for hot dip galvanizing of reinforcing, mesh, and accessories. Provide certified copies of test results for hot-dip reinforcing steel and accessories. The test reports shall indicate that the hot dip galvanized coating meets or exceeds ASTM A767. The certificates must be signed by the galvanizer and contain a detailed description of the material processed. Reinforced concrete shop drawings are to be certified by the galvanizer and submitted to IDOT for approval.
- F. If applicable, provide manufacturer's data for synthetic reinforcing fibers. Identify all placements that are to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each placement shall be noted.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Store galvanized reinforcing steel on padded supports above ground, cover and keep it clean and dry.
- B. Galvanized Reinforcing: Deliver, store, and handle galvanized reinforcing in a manner to protect the galvanizing from damage and in accordance with accepted industry standards.
- C. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in legible manner with waterproof markings showing the same "mark " designations as those shown on the submitted Placing Drawings.
- D. Store galvanized bars off the ground to allow air circulation and to prevent the formation of wet storage stain.

1.06 QUALITY ASSURANCE

- A. Coating Applicator: Company specializing in hot dip galvanizing and following the procedures in the Quality Assurance Manual of the American Galvanizers Association.
- B. Acceptable Coating Applicators: Members of the American Galvanizers Association.

PART 2 PRODUCTS

2.01 REINFORCING BARS, FABRIC AND ACCESSORIES

- A. Hot-Dip Galvanized Steel Reinforcement Bars and Dowels: ASTM A615, Billet Steel Bars, Grade 60 all sizes; deformed bars ASTM A767. Fabricate and bend bars prior to galvanizing. Bars already galvanized shall be bent by cold forming only; heated bending of bars after galvanizing not permitted. Repair damaged galvanizing in accordance with ASTM A780.
- B. Galvanized Welded Wire Fabric: ASTM A185 fabric and galvanized in accordance with ASTM A123. Size of wire and spacings as indicated on the drawings. If not indicated use WWF 6X6 W2.9XW2.9 minimum. Furnish in sheets rather than rolls.
- C. Fabrication of reinforcement shall be in compliance with the CRSI Manual of Standard Practice and ACI 315 and ASTM A 143, A 384 and A 385, except as specified herein. Bars shall be cold bent. Avoid fabrication techniques that could cause distortion or embrittlement of steel. Bars shall not be straightened or re-bent.

- D. Bar Supports, General: Provide bar supports and other accessories in accordance with CRSI "Recommended Practice for Placing Reinforcing Bars", unless otherwise specified. Provide support to hold reinforcing in proper position while concrete is being placed. Where used over moisture barriers in slabs on grade, provide precast concrete supports or other type supports having bearing sand plates to prevent damaging the moisture barrier.
- E. Bar Supports, ties and Accessories for Use with Galvanized Reinforcing: In addition to the general requirements for bar supports, comply with the following for use with galvanized reinforcing.
 - 1. Wire Supports: Galvanized wire, compatible with concrete, for a distance at least 2" from the point of contact with the galvanized reinforcing bars.
 - 2. Precast Concrete Block Supports: May be used for footing foundations and slabs-on-grade. Precast concrete blocks, if containing reinforcement, the metal reinforcement shall be galvanized, compatible with concrete.
 - 3. Plastic Supports: All plastic assembly, dielectric, compatible with concrete.
 - 4. Provide spreader bars, bar clips and spreaders, and other accessories galvanized and compatible with concrete.
 - 5. Tie wires: Sixteen gauge or heavier No. 9 galvanized tie down wires.
 - 6. Provide plastic tipped accessories for reinforcement at all faces of exposed concrete, interior or exterior.
- F. The fabricator shall consult with the galvanizer and IDOT regarding potential problems or potential handling problems during the galvanizing process that may require modifications of design before fabrication proceeds.

2.02 GALVANIZING

- A. All reinforcing bars, dowels, mesh, ties, supports, and accessories shall be hot dip galvanized.
- B. Reinforcing bars shall be cut to size and bent as required prior to galvanizing. Bend bars in the shop according to the minimum bend diameters required by Table 2 of ASTM A 767.
- C. Pre-clean reinforcing in accordance with accepted methods to produce the best possible surface for quality hot dip galvanizing.
 - 1. Remove all welding slag, splatter, anti-splatter compounds and burrs prior to delivery to the galvanizer.
 - 2. Surface contaminants that are not removable by the normal chemical cleaning process in the galvanizing operation should be removed by blast cleaning or an alternative method, prior to delivery of the steel to the galvanizer.
- D. All surfaces of all reinforcing must be hot dip galvanized in accordance with ASTM A 123. Galvanize miscellaneous hardware such as chairs and tie-wires in accordance with ASTM A 153.
- E. Safeguard products against steel embrittlement in conformance with ASTM A 143. Handle all articles to be galvanized in such a manner so as to avoid any mechanical damage and to minimize distortion.
- F. Surface Touch-Up: Tears or sharp spikes shall be removed by hand-sanding or power-tool grinding. These operations shall remove excess zinc, while leaving behind a fully compliant zinc coating with the required minimum thickness. If the coating thickness in the touched up area falls below the minimum specified thickness, the area may be repaired as detailed in ASTM A 780.

- G. Where necessary, galvanizing shall be repaired according to ASTM A780. Locations, extent, procedure and materials used for galvanizing repair shall be submitted to IDOT for review and approval.
 - 1. Coat ends of reinforcing bars or wire cut in the field after galvanizing with zinc rich galvanizing repair paint as approved by IDOT and unless directed otherwise.
- H. After galvanizing, clean reinforcing of excessive flux or other materials that may interfere with concrete encasement.

2.03 GALVANIZING COATING

- A. Coating Weight: Conform with Table 1 of ASTM A 767, Table 1 of ASTM A 153, or Tables 1,2 and 3 of ASTM A 641, as appropriate.
- B. Surface Finish: Continuous, adherent, smooth, and as evenly distributed as possible and free from any defect detrimental to the stated end-use of the coated article.
- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.
- D. Special Quality Provisions: Galvanized reinforcing bars that are “frozen” together shall be rejected. The presence of tears or sharp spikes shall be cause for rejection.
- E. Galvanizing Finish: The coating shall have a uniform appearance free from uncoated spots, acid, flux or black spots.

2.04 TESTS

- A. Inspection and testing of hot dip galvanized coatings shall be done under the guidelines provided in the AGA publication “Inspection of Products to be Hot Dip Galvanized After Fabrication”.
- B. Include visual examination and tests in accordance with ASTM A 767, A 153 or A 641 as applicable to determine the thickness of the zinc coating on the metal surface.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the areas to receive the Work and the conditions under which the work will be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Surface condition, bending, spacing and tolerances of placement of reinforcement shall comply with the CRSI Manual of Standard Practice and ACI 301. The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.
- C. Comply with applicable portions of Section 420.09 and 420.10 of Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation, adopted Jan. 1, 2002.
- D. Prior to placing reinforcement, all grease, dirt, mortar and other foreign substances shall be removed from all surfaces of reinforcing.

3.02 PLACING REINFORCING BARS

- A. General: Install and place reinforcing in accordance with approved reinforcing placement shop drawings or precast concrete panel shop drawings, in accordance with "Manual of Standard Practice" as published by the Concrete Reinforcing Steel Institute or "PCI MNL 116 Manual for Quality Control Plants and Production of Structural Precast Concrete Products" respectively.
- B. Unless indicated otherwise, all reinforcing bars shall have at least 2 inches of protective concrete cover.
Maintain the following surface clearance dimensions plus 1/4":
 - 1. Concrete cast against and permanently exposed to earth, 3 inches.
 - 2. Slabs on grade, 2 inches.
 - 3. Concrete surfaces in contact with water or exposed to weather, 2 inches.
 - 4. Concrete not exposed to earth, water or weather: 1 inch for slabs, 1 1/2" for beams and columns.
 - 5. Precast concrete –see specification 03 40 00 Precast Structural Concrete.
- C. Reinforcing bars shall extend 12 bar diameters but not less than 12" beyond bend unless noted otherwise.
- D. Support and secure reinforcing with accessories and tie wire to prevent displacement before and during concreting. Concrete shall not be poured if bars are not properly and securely placed with adequate supports.
- E. Reinforcement bars shall be supported, as specified herein, and their distances from faces of forms shall be maintained by means of approved blocks, ties, hangers, or other supports.
- F. Ties: Bars should be securely tied to prevent displacement during concreting operation with epoxy coated tie wire.
- G. All bar bends and hooks shall be in accordance with ACI 318 unless indicated otherwise on the drawings.

- H. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings, specified herein, or unless approved in writing by IDOT. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.
- I. Reinforcing steel interfering with the location of other reinforcing steel, conduits, or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of IDOT. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of IDOT.
- J. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by IDOT. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace. Coldweld or otherwise repair as directed by IDOT. When coated reinforcing steel bars are field bent, coating damage shall be repaired in accordance with the applicable ASTM Standard. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.
- K. When coated reinforcing steel bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

3.03 REINFORCEMENT AROUND OPENINGS

- A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.04 ACCESSORIES

- A. Determine, provide and install accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather or water. Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified herein.

3.05 SPLICES

- A. Bar Splices: Bar splices shall be permitted only where shown on the drawings. Should the Contractor desire to splice bars at locations other those shown on the drawings, written permission must be obtained from IDOT. Such splices shall be distributed or located at points of low tensile stress. Splices shall not be permitted unless a minimum of two inches can be provided between the spliced bar and the nearest adjacent bar. All splices for bars shall be made by use of a mechanical connector or by placing the bars in contact and wiring them together for the length of the splice.
- B. Lap Splices: All spliced bars shall have a minimum lap splice lengths as indicated on the drawings or longer as otherwise required by ACI standards or codes; ACI Standard Class B for Top/Bottom Bars. Where bars of different sizes lap, provide lap splice length for

larger bar.

- C. Provide standard reinforcement splices by lapping ends, placing bars in contact, and wiring tightly together.
- D. Welded wire fabric shall be lapped at least eight inches, or one wire space, whichever is greater, at ends and edges as well as wired together.

3.06 INSPECTION

- A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been observed by IDOT and the IDOT's release to proceed with the concreting has been obtained. IDOT shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until IDOT has finished observations of the reinforcing steel.
 - 1. If the reinforcement is not placed according to the tolerances noted herein, IDOT shall require the Contractor to reposition the reinforcing.
 - 2. All concrete placed in violation of this provision shall be rejected, removed and corrective work shall be at no cost to IDOT.

3.07 REPAIR OF REINFORCING

- A. General: Repair or remove and replace damaged galvanized reinforcing, as approved by IDOT.
- B. The maximum area to be repaired is defined in accordance with ASTM A 123, Section 6.2, current edition.
 - 1. Repair areas damaged by welding or flame-cutting or during handling, transport or erection by one of the approved methods in accordance with ASTM A 780 when damage exceeds 3/16" in width. Minimum thickness requirements for the repair are described in ASTM A 123, Section 6.2, current edition.

END OF SECTION 03 20 00

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for cast-in-place concrete. The work under this Section shall consist of furnishing all labor, materials, and equipment required to provide and install the cast-in-place concrete structures shown on the drawings and including formwork, joint filler, isolation joint, water stops, embedded items, vapor retarder, floor sealer and all other appurtenant work required to complete this work. The concrete work includes slabs on grade, structural slabs, concrete topping slab, concrete steps, concrete foundations, footings, piers and other concrete structures.
- B. Furnish all sampling and testing as required for qualification of proposed materials and establishment of design mixes and performing field testing of all concrete by a qualified testing laboratory acceptable to the Authority and engaged by and at the expense of the Contractor.
- C. Related Sections: The following sections contain requirements that relate to this Section.
1. Section 01 45 80 - Testing and Inspection Service
 2. Section 31 20 00 - Earthwork
 3. Section 03 20 00 - Concrete Reinforcement Galvanized

1.03 STANDARDS

- A. Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
1. American Concrete Institute (ACI).
 2. American Society for Testing and Materials (ASTM).
 3. Illinois Department of Transportation (IDOT) Standard Specification for Road and Bridge Construction.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 2. ASTM C33 Standard Specification for Concrete Aggregates.
 3. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 4. ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 5. ASTM C94 Standard Specification for Ready Mixed Concrete.
 6. ASTM C143 Standard Test Method for Slump of Hydraulic Cement Concrete.
 7. ASTM C150 Standard Specification for Portland Cement.
 8. ASTM C156 - Standard Test Method for Water Retention by Concrete Curing Materials.
 9. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.

10. ASTM C172 - Practice for Sampling Freshly Mixed Concrete.
11. ASTM C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
13. ASTM C260 Standard Specification for Air Entraining Admixtures for Concrete.
14. ASTM C309 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
15. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C979 - Color Pigment for Concrete.
18. ASTM C1064 - Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
19. ACI 117, "Standard Tolerances for Concrete Construction and Materials."
20. ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
21. ACI 301, "Specifications for Structural Concrete for Buildings."
22. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
23. ACI 305, "Hot Weather Concreting."
24. ACI 306, "Cold Weather Concreting."
25. ACI 308, "Standard Practice for Curing Concrete."
26. ACI 309, "Standard Practice for Consolidation of Concrete."
27. ACI 318, "Building Code Requirements for Reinforced Concrete."
28. ACI 347, "Recommended Practice for Concrete Formwork."

1.04 SUBMITTALS

A. Submit the following, in accordance with Section 01 30 00, Submittals.:

1. Sources of cement and aggregates.
2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, field testing methods and conformity to ASTM standards.
4. Water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
5. Accelerating/retarding admixtures. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
6. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. The mix design shall be signed and sealed by either an Illinois Professional Engineer or Structural Engineer. The mix designs shall specify weight and type of Portland Cement, fine aggregate, coarse aggregate, brand names and amounts of chemical admixtures, range of water content, range of slump and expected compressive strength for seven, fourteen and twenty-eight days. Provide the following for each mix proposed. Results are to be no older than 1 year from date of concrete pour.
 - a. Compression test results for proposed mixes. Include standard deviation data for each proposed concrete mix based on statistical records where applicable.
 - b. Curve of water-cementitious materials ratio versus concrete cylinder

strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests if available.

- c. Fine aggregates – Test reports indicating conformity with ASTM standards, including sieve analysis, physical properties, and deleterious substance.
 - d. Coarse aggregates – Test reports indicating conformity with ASTM standards, including sieve analysis, physical properties, and deleterious substances.
 - e. Cements – Test reports indicating conformity with ASTM standards, including chemical analysis and physical properties for type.
 - f. Contractor shall submit documentation from the concrete suppliers indicating previous experience with the proposed mix design.
7. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.
 8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.
 9. Concrete floor sealer product data, specifications and instructions for application.
 10. Concrete stain product data, specifications and instructions for application.
 - a. Provide color charts for manufacturer's standard colors for Authority's selection and approval.
- B. The Contractor shall provide the following for review and approval: product data for materials and items including forming materials and accessories, form release agents, admixtures, patching compounds, bonding agents, joint systems, curing compounds and others as requested. Certify that each admixture is compatible with others used.
- C. The Contractor shall submit formwork shop drawings for concrete exposed to view indicating fabrication, erection and support procedures for the formwork to the Authority for approval. The formwork drawings shall be signed and sealed by an Illinois licensed professional or structural engineer. Show form construction including jointing, special form joints, location and pattern of form tie placement and other items that affect exposed concrete visually. The Contractor shall make modifications to the procedure if required, to obtain results that are satisfactory to the Authority, but it is understood that the Authority's approval shall not relieve the Contractor from sole responsibility of obtaining satisfactory results.
- D. Provide material certificates in lieu of material laboratory test reports, when permitted. Certificates shall be signed by the manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- E. Provide delivery tickets for all ready-mixed concrete. Tickets to include the following information:
1. Significant times during the process such as start load, end load, leave plant, arrive job, begin pour, and end pour.
 2. Date
 3. Truck number
 4. Driver number
 5. total yards in truck
 6. total yards for order
 7. plant location
 8. delivery location

9. mix number
 10. other items added to the mix prior to loading, during loading or after loading not already indicated in the approved mix design, including when it was added.
- F. Provide batch reports for all ready-mixed concrete. Tickets to include the following information:
1. Significant times during the process such as batch time, start load, end load.
 2. Date
 3. Truck number
 4. Driver number
 5. total yards in load
 6. plant location
 7. delivery location
 8. mix number
 9. Description of all ingredients
 10. Design quantities of all ingredients
 11. Actual quantities of all ingredients
 12. total weight of load
 13. Design w/c ratio
 14. Actual w/c ratio
 15. Percent moisture of aggregates
- G. Provide product data, specifications, installation instructions, samples, and other information for the following:
1. Water stops.
 2. Joint filler and isolation joint materials.
 3. Vapor retarder.
- H. Provide compatibility test results between adjacent sealants and curing and sealing materials.
- I. As-Built requirements: Pursuant to Division One Section, Closeout Procedures, provide as-built drawings indicating actual locations and elevations of all foundations, foundation elements, openings and other features upon completion of the project.
- J. Provide two copies of test reports from the Contractor's testing agency verifying concrete strength.

1.05 QUALITY ASSURANCE

- A. Reinforced concrete shall comply with the latest ACI codes: ACI 301, Specification for Structural Concrete; ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete; ACI 311, ACI Concrete Inspection Manual; ACI 315, ACI Detailing Manual; ACI 318, Building Code and Commentary; and ACI 347, Guide to Formwork for Concrete. The most stringent requirement of the codes, standards, building codes and this Section shall apply when conflicts exist.
- B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.
- C. Testing of the following materials shall be furnished by Contractor to verify conformity with this Specification Section and the stated ASTM Standards.
1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
 3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.
 4. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.
- D. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the job for each type of concrete required, in compliance with ACI 318 (Chapter 4). In addition, documentation shall be provided demonstrating that the proposed concrete proportions will produce an average compressive strength at least 15% higher than the herein specified compressive strengths.
- E. Use ready-mix concrete, complying with ASTM C94 and supplied by a ready-mix source which is inspected yearly by the Illinois Department of Transportation. Delivery tickets shall note the mix designation, admixtures, time dispatched, date, project number and Contractor and shall be submitted for review by the Authority.
- F. Testing: Contractor shall arrange for and pay for an independent testing laboratory, approved by the Authority, to perform the following tests; providing a copy of all reports to the Authority for approval:
1. Concrete sampling for design mix, air content and slump.
 2. Concrete cylinders for 7, 14, and 28 day compression strength.
 3. Backfill compaction testing.
 4. Conduct specified Source Quality Control and Field Quality Control and submit reports for all concrete work.
- G. Provide quality assurance according to Section 1020 of the IDOT Standard Specifications.
- H. See also Section 01 45 80, Testing and Inspection Service.

1.06 PROJECT CONDITIONS

- A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete performance.
- B. Principal opening sizes and locations are indicated on the drawings. Additional smaller openings and sleeves may be required by other disciplines and shall be constructed according to details submitted to the Authority for approval.

1.07 COORDINATION

- A. Coordinate work of this section with other subcontractors to verify required dimensions and locations including for inserts, anchors, anchor bolts, plates, conduit, and other items to be embedded in the concrete or installed with the concrete.
- B. Coordinate the delivery of embedded items or items to be installed with the concrete so as to avoid delays to the installation of the new concrete work.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store weathertight to provide protection from dampness and contamination.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination

with other materials or with other sizes of like aggregates. Do not use frozen or partially frozen aggregate.

- C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen sand.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.
- E. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
- F. Liquid Curing Compounds: Store in closed containers.
- G. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 CLASS SI CONCRETE

- A. All concrete defined by this specification shall be Class SI Concrete having a compressive strength as shown on the drawings, or if not shown, as indicated herein, and conform to the requirements of Sections 503 and 1020 of the IDOT Standard Specifications.
- B. Cement: Domestic Portland cement, Type I or II (Type III used only when high early strength is needed and as approved by CTA), complying with ASTM C150.
- C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.
- D. Coarse Aggregate: Maximum size aggregate shall be $\frac{3}{4}$ inch. Well graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 for the specified coarse aggregate size number.
- E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.
- F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). Each admixture shall be compatible with all of the components in the concrete mix and shall be suitable when it is required to use more than one admixture in a concrete mix. Admixtures shall be compatible with the concrete mix including other admixtures potable water after 30 days.
 - 1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
 - 2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
 - 3. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Authority. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.

- G. The use of calcium chloride and other chloride containing agents is prohibited.
- H. Sheet Curing Materials: Waterproof paper, polyethylene film or white burlap polyethylene sheeting all complying with ASTM C171.
- I. Liquid Curing Compound: Liquid membrane forming curing compound shall comply with the requirements of ASTM C309, Type 1 D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compounds shall have a minimum of 18 percent solids, be non-yellowing and have a unit moisture loss no greater than 0.55 kg/m² in 72 hours as measured by ASTM C156.
- J. Concrete Sealer: Water based, odorless, colorless; that penetrates, hardens and densifies concrete surfaces and leaves a nondarkening film that protects the concrete surface from oil, water, grease, dirt and other contaminant penetration. Sealer must be compatible with any concrete admixtures, color stains, curing compounds, hardeners, and any other concrete treatments used. Sealer must meet current local VOC restrictions and be non-flammable.
 - 1. Concrete sealer to be Hydrozo 100 Plus as manufactured by BASF Chemical Company or a sealer with similar characteristics. Manufacturers of concrete sealers that may be used for this project include, but not limited to, the following:
 - a. BASF.
 - b. ChemMasters.
 - c. Custm Building Products, Aqua Mix Sealer's Choice Gold.
 - d. SpecChem.
 - e. TK Products.
 - f. H & C Concrete Coatings.
 - g. Approved Equal.

2.02 MIXES

- A. Select proportions of ingredients to meet the design strength and materials limits specified and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.
- B. Slump of the concrete shall be as measured by ASTM C143. If a high-range water reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 6- to 8-in.
- C. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.
- D. Design mixes, when tested according to ASTM C 330, to be as indicated on the drawings, or if not indicated, provide normal weight structural concrete with 4000 psi at 28-day compressive strength, 0.44 maximum water-cement ratio for non-air-entrained concrete and 0.40 maximum for air-entrained concrete.
 - 1. Design mix for concrete topping slab to be 4000 psi at 28 days; unless directed otherwise.

- E. Slump Limits for Normal Weight Concrete: Proportion and design mixes to result in a concrete slump at point of placement of 4" to 6"; with superplasticizer the maximum concrete slump at point of deposit to be 6" to 8",
- G. Normal weight aggregates to conform to ASTM C 33 unless specified otherwise. Maximum aggregate size to be 3/4 inch.
- H. Air Entraining Admixture: ASTM C 260; provide for exterior exposed concrete and as otherwise required: 4-7%.
- I. Water Reducing Admixture (Superplasticizer): ASTM C 494; provide for exterior exposed concrete and concrete with a water-cement ratio of 0.50 or less. Type as specified or approved by Authority. Type "A" water-reducing admixture, added in compliance with the manufacturer's recommendations - with no reduction in the specified cement content. (Type "D" water-reducing admixture may be used in lieu of Type "A" during hot weather concreting).
- J. Admixtures containing chlorides shall not be used in the concrete.
- K. Fly ash shall be used conforming to Sections 1010 and 1020.05 of the IDOT Standard Specifications. When used, the fly content shall be no less than 15 percent nor more than 25 percent of the total cement, by weight
- L. Adjustments to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by the Authority. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Authority.
- M. No other admixtures shall be added without written approval from the Authority. The use of calcium chloride and other chloride containing agents is prohibited. Additives such as accelerators, retarders, anti washout agents (AWA) may be used if approved by the Authority.
- N. Concrete Stain: Apply stain to concrete after installation of slab according to stain manufacturer's written instructions and to create results in hardened concrete color consistent with approved mockup.

2.03 READY MIXED CONCRETE

- A. Provide ready mixed concrete in accordance with ASTM C94 and as specified. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
 - 1. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.
 - 2. Do not use concrete in the work if it undergoes initial set or is not deposited within 90 minutes after the water is introduced. Do not add water to unworkable concrete at delivery end unless the testing laboratory accepts the procedure.
- B. Provide an official ticket for each ready mix truck delivery indicating all pertinent data for that load.

2.04 FORMWORK MATERIAL

- A. General: Forms to provide continuous, straight, smooth, exposed surfaces. Furnish forms in largest practicable sizes to minimize number of joints.

- B. Wood Forms:
1. Finish No. 1 (for concealed below-grade concrete) exterior plywood B-B concrete form Class II PS-1-74.
 2. Finish No. 2 (for smooth exposed concrete) exterior type, resin coated plywood, high density concrete form overlay, Class I, PS-I-74.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.
- D. Form release agent: A non-staining form release agent shall be used on all form work. Form release agent used shall not damage form liner.

2.05 WATERSTOP

- A. Waterstop to be flexible rubber waterstop, CECRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections and directional changes.
1. Manufacturers:
 - a. Greenstreak.
 - b. Progress Unlimited, Inc.
 - c. Williams Products, Inc.
 - d. Approved equal.
 2. Profile: Flat, dumbbell with center bulb unless shown otherwise.
 3. Dimensions: 6 inches by 3/8 inch thick unless shown otherwise.

2.06 JOINT FILLER

- A. Expansion Joint Filler: Bituminous preformed joint filler conforming to ASTM D 1751. Strips to be full depth of concrete and 3/4" thick unless noted otherwise.

2.07 ISOLATION JOINT

- A. Isolation joints are to be 1/2 inch wide.
- B. Isolation joint material to be BASF expansion joint filler and Sonolastic SL-2 (or approved equal).

2.08 REINFORCING MATERIALS

- A. Refer to Section 03 20 00, Concrete Reinforcement Galvanized, of these specifications for concrete reinforcing materials.

2.09 RELATED MATERIALS

- A. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E154 such as polyethylene sheet not less than 6 mils thick.
- B. Curing and Sealing Compounds: Clear concrete curing and surface sealing compound complying with ASTM C309, Type I, Class A; water-based acrylic coating.

- C. Latex Bonding Agent: Provide Bonding Agent per manufacturer's recommendations when placing new cast-in-place concrete against existing concrete. Bonding Agent shall comply with ASTM C1059, Type 11 – exterior use.

PART 3 EXECUTION

3.01 PREPARATION

- A. Determine that subgrades, excavations, and other surfaces where concrete is to be placed are of proper bearing capacity, of solid material, undisturbed, of proper compaction if filled.
- B. Determine that excavations are of proper size, at proper depth, and properly located.
- C. Excavations and subgrades where concrete is to be placed must be clean and dry.

3.02 FORMS

- A. Forms shall be constructed so that the completed concrete structures conform to the shape, lines and dimensions of the members as shown on the Drawings, within tolerances allowed by the Standard Specifications. They shall be properly braced or tied together to maintain position and shape. Forms shall be made sufficiently tight to prevent leakage of mortar. Provide for openings, offsets, recesses, chamfers, blocking, anchorages, inserts and other features required in the work. Provide for thickened slabs where shown or required of proper width and depth and provide required recesses in the slab.
- B. Provide openings in concrete formwork to accommodate work of other trades. Coordinate with all other trades.
- C. Forms and adjacent surfaces to receive concrete to be clean and free of old concrete, grease and debris.
- D. The formwork shall be removed when the concrete is strong enough to withstand any applied forces and permission has been obtained from the Authority.
- E. Form ties shall be non-exposed cone type and shall be spaced as shown on the drawings or as approved by the Authority. All cones shall be filled with concrete after removal of the formwork.
- F. The Contractor is required to use a surveyor to properly locate the formwork, including elevations.
- G. The Contractor shall use smooth surfaced forms with tight joints for any concrete work that will remain exposed to view, either partially or fully; as determined prior to installation of the forms.

3.03 PLACING REINFORCEMENT

- A. See Section 03 20 00, Concrete Reinforcement Galvanized. Reinforcement to be clean and free of rust, scale, dirt, and ice. Accurately position, support, and secure reinforcement. Place reinforcement to maintain minimum coverages for concrete protection. Install bars and welded fabric in longest lengths practicable, lapping at all splices. Offset laps to prevent continuous laps in either direction.
- B. Reinforcement shall have the following minimum cover, unless noted otherwise:

1. Surfaces not formed: 3 inches.
 2. Formed surfaces in contact with soil or water: 3 inches.
 3. Formed surfaces not in contact with soil or water: 2 inches.
- C. Corner bars matching interior and exterior wall face horizontal bars shall be provided at all wall intersections. See drawings.
- D. Grouted reinforcing anchors shall be Hilti HY-150 Max. Adhesive or an equal system approved by the Authority.
- E. The Contractor is to notify the Authority when reinforcement bars are installed. Placement of concrete shall not commence until the Authority has inspected and approved the reinforcement placement.

3.04 JOINTS

- A. Construction Joints: Locate and install construction joints as shown on the drawings or so they do not impair the strength or appearance of the structure, as acceptable to the Authority.
- B. Provide keyways at least 1-1/2 inches deep in construction joints between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Isolation joints between new concrete and existing concrete, shall be filled with a premolded joint filler and sealing compound.
- F. Only those construction joints shown on the drawings will be allowed unless approved otherwise by the Authority.
- G. Control Joints. Depth to be T/4, min 1", spaced at 15' o.c. max. with a max aspect ratio of 1.5:1, unless otherwise noted on the drawings.

3.05 EXPANSION JOINTS

- A. Provide expansion joints at all intersections with other slabs, at existing elements, vertical surfaces, at abutments with other structures, and at other locations where indicated or required. Expansion joints to be 3/4" unless noted otherwise. Expansion joints to be continuous and for the full depth of the concrete except for space for sealant.

3.06 ISOLATION JOINTS

- A. Provide isolation joints where shown or required. Isolation joints to be 1/2" unless noted otherwise. Isolation joints to be continuous and for the full depth of the concrete except for a 1/4" space for sealant.

3.07 WATERSTOPS

- A. Install waterstops where shown or required to form a continuous diaphragm. Install in longest lengths practical. Support and protect exposed waterstops during progress of the work. Field fabricate joints in waterstops by sealing according to manufacturer's written

instructions.

- B. Waterstops shall be secured in place by splitting the concrete form. The center bulb shall be centered in the joint. While concrete is being placed the concrete shall be thoroughly vibrated to insure complete embedment of the ribbed flanges.

3.08 VAPOR RETARDER

- A. Place vapor retarder under concrete slabs and other at- or below-grade applications. Use largest available sheets. Overlap edges and seal as recommended by manufacturer.

3.09 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. All exposed concrete corners shall be broken with a 3/4" x 3/4" chamfer or should match existing or adjacent work.
- C. Place steel plates, angles, anchor bolts, plate and nelson stud assemblies, etc. as shown into concrete before it sets. Position embedded anchor bolts using templates.
- D. Unless otherwise shown or approved, conduits and pipes embedded within a slab, wall or beam shall have a maximum outside dimension no greater than one third the overall thickness of the slab, wall or beam; and spacing shall be greater than or equal to three diameters or widths on center.
- E. Provide continuous water stops at each construction joint of any concrete element exposed to soil or water below grade. Provide a 1 1/2 inch by 3 1/2 inch continuous key at each joint requiring water stops.
- F. Electrical and communication conduits shall not be placed in concrete without prior approval by the Authority.

3.10 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
- C. All exposed concrete edges shall have a 3/4 inch chamfer.

3.11 MEASURING MATERIALS

- A. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a concrete mixing plant acceptable to the Authority. All constituents, including admixtures, shall be batched at the plant.
- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified.

- C. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as batched on printed batching tickets.

3.12 MIXING AND TRANSPORTING

- A. Concrete shall be ready mixed concrete; no hand mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- B. Ready mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Authority. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.
- D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.
- E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal lined non aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- F. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- H. Furnish a delivery ticket for ready mixed concrete to the Authority as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- I. Temperature and Mixing Time Control:
 - 1. In cold weather, do not allow the as mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.
 - 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.
 - 3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well crushed ice for all or part of the mixing water.

- J. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms with concrete agitated shall not exceed the following:
1. If the air or concrete temperature (whichever is higher) is between 80 to 90 Degree F, the maximum time shall not exceed 45 minutes.
 2. If the air or concrete temperature (whichever is higher) is between 70 to 79 Degree F, the maximum time shall not exceed 60 minutes.
 3. If the air or concrete temperature (whichever is higher) is between 40 to 69 Degree F, the maximum time shall not exceed 90 minutes. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.
- K. Concrete Stain: Apply concrete stain to installed cured concrete according to manufacturer's written instructions for areas to receive stained concrete. Verify locations for color concrete. Concrete to be stained to be clean, dry and cured. Mix stain and apply as directed by manufacturer. Follow manufacturer's recommendations for installation

3.13 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. No concrete shall be placed without 24-hour advance notice to the Authority nor before the formwork and setting of reinforcement has been inspected and approved by the Authority.
- C. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- D. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms and exposed concrete joints. Voids in sleeves, inserts, etc., shall be filled temporarily with readily removable material to prevent entry of concrete. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can assure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.
- E. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
- F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for

- consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- G. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
 - H. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
 - I. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.
 - J. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.
 - K. All exposed concrete edges shall have a $\frac{3}{4}$ inch chamfer.
 - L. Provide concrete footings, walls, slabs, steps, pits, thickened slabs, piers for light poles and bollards, and other concrete installations as shown on the drawings. Form and provide for pockets for rails, trench drains, and drop concrete at doors as shown on the drawings. Provide dowels where new concrete meets existing as detailed on the drawings.
- 3.14 COLD WATER CONCRETING:
- A. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.
 - B. Cold weather concreting shall conform to ACI 306.1 and with the applicable provisions of the Standard Specifications. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - C. Discuss a cold weather work plan with the Authority. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Authority.
 - D. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents

or chemical accelerators unless otherwise accepted in mix designs.

- E. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree days of curing.
 - 1. Degree days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g., 5 days at an average 70 degrees F = 350 degree days).
 - 2. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
- F. Salt, manure or other chemicals shall not be used for protection.
- G. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

3.15 HOT WEATHER CONCRETING

- A. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr.
- B. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305 and the additional requirements specified herein.
- C. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.
- D. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the site and to provide vibration immediately after placement.
- E. The Authority may direct the Contractor to immediately cover plastic concrete with sheet material.
- F. Discuss with the Authority a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Authority.
- G. Hot-Weather Placement:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 - 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Authority.

- H. Do not apply unbalanced loads, such as hydrostatic pressure or backfill against structural components until the concrete has attained its design strength.

3.16 NOT USED

3.17 SLABS

- A. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
- B. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.
- C. Provide tape or other approved means to separate between concrete slab that is to be stained and concrete slab that is to remain natural. Lay out straight and even joints. Verify and set dimensions and locations for extent of stained concrete.
- D. All new slabs shall be placed on minimum 6" engineered fill compacted to 95% relative density.

3.18 COMPACTING FORMED CONCRETE

- A. Consolidate concrete by mechanical vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc., shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.
- B. Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:
 - 1. Frequency returns to normal.
 - 2. Surface appears liquefied, flattened and glistening.
 - 3. Trapped air ceases to rise.
 - 4. Coarse aggregate has blended into surface, but has not disappeared.

3.19 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete. Repair and patch defective areas with fins and other projections completely removed and smoothed.

3.20 MONOLITHIC SLAB FINISHES

- A. Unless noted otherwise, concrete slabs to be 6" thick and reinforced with wire mesh. Provide vapor barrier under slab unless indicated otherwise.

- B. Pitch slabs to drains where drains are indicated without reducing the thickness of the slab. Minimum slope is 0.1%. Provide recesses or drop top of slab as required for finish floor materials. Verify locations.
- C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared and concrete has sufficiently stiffened. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- D. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view.
 - 1. After floating, begin troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to concrete stair treads, ramps and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.
- F. Sawing of control joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling and no later than 12 hours after concrete is poured. All joints shall be a minimum of one inch deep and sawed to the length shown on the drawing before uncontrolled shrinkage cracking takes place.

3.21 CONCRETE CURING AND PROTECTION

- A. Curing shall be in accordance with the applicable portions of Section 1020.13 of the IDOT Standard Specifications. Concrete floor slabs to be cured per IDOT Standard Specifications section 1020.13.a.5 for 3 days.
- B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material.
- C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- D. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
 - 1. Water Curing: Provide water curing by continuous water-fog spray or cover concrete surface with approved absorptive cover and thoroughly saturate cover with water. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day for 3 continuous days
 - 2. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
 - 3. Liquid Membrane Curing: Apply over the entire concrete surface except for

surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations. Apply curing compound on exposed interior slabs and on exterior slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation according to manufacturer's directions.

- E. Specified applications of curing methods.
 - 1. Slabs for Water Containment Structures and Chemical Spill Basins: Water curing only.
 - 2. Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
 - 3. Slabs on Grade and Structural Slabs (other than water containment): Water curing.
 - 4. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the Substrate: Water curing.
 - 5. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cure or liquid membrane cure if forms are removed prior to 7 days.
 - 6. Concrete Joints: Water cured or sheet material cured.
- F. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.
- G. The Contractor shall provide all necessary measures to prevent any water, frost or ice from penetrating the concrete prior to and after placement of concrete and until the concrete has obtained required strength.

3.22 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Forms shall not be removed before the concrete has attained a strength of at least 30 percent of its specified design strength. Shores shall not be removed until the concrete has attained at least 60 percent of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

3.23 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Authority.
- B. The external surface of all concrete shall be thoroughly worked during the operations of placing in such a manner as to work the mortar against the forms to produce a smooth finish free of honeycombs and with a minimum of water and air pockets.
- C. Depressions resulting from the removal of ties, and holes left by attachments to rod or bolt anchorages, shall be carefully and neatly pointed with a mortar of sand and cement

mixed in the proportions used in the concrete.

- D. Air pockets or rough areas larger than 1/2 inch diameter occurring in any surface shall be pointed as specified in the foregoing paragraph. Honeycombed areas shall be chipped out by the Contractor and inspected by the Authority before being pointed. Pointed areas mentioned in this paragraph shall then be given a normal finish in accordance with the requirements of the Standard Specifications.
- E. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Authority.
- F. When patching defects in exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.24 CONCRETE TOPPING

- A. Provide mix and color of concrete as directed, selected and approved. Color must match color selected and be uniform for the entire project and the entire thickness of the topping.
- B. Concrete slab to be covered with topping to be clean and dry. Surface of base slab to be rough or have a scratch surface for better bonding of topping.
- C. Apply bonding agent to base slab according to bonding agent's manufacturer's recommendations and directions. Apply bonding agent to any vertical surfaces that topping will abut and surfaces where topping is placed against hardened or partially hardened topping.
- D. Provide and install wire mesh reinforcing in concrete topping slab as shown or required. Provide type and sizes of mesh and wire size as shown or required. Provide proper concrete cover, overlap ends as required and secure into place to avoid displacement during pouring operations.
- E. Install concrete topping slab to limits indicated by lowered base slab. Float finish topping slab and trowel to a smooth, uniform, level finish and to the correct height. Finish surfaces to overall values of flatness of 25 and levelness of 20.
- F. Construct joints true to line with faces perpendicular to surface plane of topping.
- G. Form weakened-plane contraction joints with power saws, 1/8" wide, when cutting action will not tear, abrade, or otherwise damage surface and before topping develops random contraction cracks.
- H. Form joints in topping over contraction joints in base slabs, unless otherwise indicated. Provide joints in both directions as recommended to eliminate surface cracking.
 - 1. Construct contraction joints for a depth equal to one-half of topping thickness.
 - 2. Joints to be straight and parallel. Follow pattern shown on drawings or as otherwise dictated. Align with column lines or other structure elements. Do not exceed 15'-0" spacing in either direction for contraction joints.
- I. Protect freshly placed topping from premature drying and excessive cold or hot

temperatures.

- J. Begin curing immediately after finishing topping, using one of the methods indicated above for curing other concrete: moisture curing, moisture-retaining-cover curing, or curing compound.

3.25 CONCRETE SEALER

- A. All exposed concrete slabs shall receive a coat of concrete sealer meeting requirements of IDOT Standard Specifications Article 1026, Concrete Sealer.
- B. Penetrating Liquid Floor Treatment: Prepare, apply and finish penetrating liquid floor treatment according to manufacturer's written instructions. Apply to all concrete floor slabs. Apply after concrete has been stained, where applicable, and stain has fully dried.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry.
 - 4. Apply a second coat in a similar manner for floors to remain exposed or if the surface is rough or porous.

3.26 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Contractor will employ and pay for a testing laboratory to obtain sets of field control cylinder specimens during the progress of the work in compliance with ASTM C31, to perform tests and to submit test reports as directed by the Authority. See Section 01 45 80, Testing and Inspection Service. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.
 - 1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28-day test results are low.
 - 2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between seven and 28-day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.
- B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed. If the slump is outside the specified range, the concrete shall be rejected.
 - 2. Air Content: Test for air content shall be made daily on fresh concrete samples using test method ASTM C 173, volumetric method for lightweight or normal weight concrete or ASTM C 231, pressure method for normal weight concrete.
 - 3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

4. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 5. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the concrete.
 7. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Authority. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
- D. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the required strengths, the Authority shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Authority shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Authority shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Authority shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.
- E. When the tests on control specimens of concrete fall below the specified strength, the Authority will order check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Authority, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the concrete structures in which such concrete was used. Tests need not be made until concrete has aged 60 days.
- F. Compression Test Reports: In addition to reporting as outlined in ASTM C39, present the following data in tabular form and distribute after recording test results:
1. Identity of project, Contractor, supplier.
 2. Identity of mix and required strength.
 3. Pour location of sampled concrete.
 4. Slump, air content, truck number, time and date sampled, air temperature, concrete temperature, consistency.
 5. Curing history.
 6. Date tested.

7. Compressive strength.
 8. Type of fracture.
 9. Compliance with specification.
- G. At the Authority's direction, concrete shown by test not to meet the specified strength requirements shall be removed and replaced at no additional cost to the Authority.

END OF SECTION 03 30 00

SECTION 03 31 10
LATEX CONCRETE OVERLAY

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for latex concrete overlay. The work under this Section shall consist of furnishing all labor, materials, and equipment required to provide and install the latex concrete overlay as shown on the drawings.
- B. Furnish all sampling and testing as required for qualification of proposed materials and establishment of design mixes and performing field testing of all concrete by a qualified testing laboratory acceptable to IDOT and engaged by and at the expense of the Contractor.
- C. Apply concrete sealer on overlay surface
- D. Related work specified elsewhere includes:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 03 40 00 - Precast Structural Concrete
- E. Related Documents
 - 1. Drawings and Division 01 Specification Sections apply to this section including Section 01 45 80 - Testing and Inspection Service.

1.02 REFERENCES

- A. Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI):
 - 2. American Society for Testing And Materials (ASTM):
 - 3. Illinois Department of Transportation Standard Specification for Road and Bridge Construction (IDOT SSRBC).
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
 - 1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 - 5. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 6. ASTM C150 - Standard Specification for Portland Cement.

1.03 SUBMITTALS

- A. Submit product data including the following:
 - 1. Mix design in accordance with material and performance requirements stated herein

2. Sources of cement and aggregates.
 3. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
 4. Manufacturer's certification that the latex emulsion meets the requirements of FHWA Research Report RD-78-35, Chapter VI. The certificate shall include the date of manufacture of the latex admixture, batch or lot number, quantity represented, manufacturer's name, and the location of the manufacturing plant. The latex emulsion shall be sampled and tested in accordance with RD-78-35, Chapter VII, Certification Program.
 5. Fine aggregates – Test reports indicating conformity with ASTM standards, including sieve analysis, physical properties, and deleterious substance.
 6. Coarse aggregates – Test reports indicating conformity with ASTM standards, including sieve analysis, physical properties, and deleterious substances.
 7. Cements – Test reports indicating conformity with ASTM standards, including chemical analysis and physical properties for type.
 8. Contractor shall submit documentation from the concrete suppliers indicating previous experience with the proposed mix design.
 9. Certified Field Quality Control Inspection and Test Reports.
 10. Sawcut layout plan per Contract Drawings
- B. Provide material certificates in lieu of material laboratory test reports, when permitted. Certificates shall be signed by the manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- C. Provide delivery tickets for all ready-mixed concrete.

1.04 QUALITY ASSURANCE

- A. Reinforced concrete shall comply with the latest ACI codes: ACI 301, Specification for Structural Concrete; ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete; ACI 311, ACI Concrete Inspection Manual; ACI 318, Building Code and Commentary; and ACI 347, Guide to Formwork for Concrete. The most stringent requirement of the codes, standards, building codes and this Section shall apply when conflicts exist.
- B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.
- C. Testing of the following materials shall be furnished by Contractor to verify conformity with this IDOT SSRBC and the stated ASTM Standards.
1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
 2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
 3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.
- D. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the job for each type of concrete required, in compliance with ACI 318 (Chapter 4). In addition, documentation shall be provided demonstrating that the proposed concrete proportions will produce an average compressive strength at least 15% higher than the herein specified compressive strengths.
- E. Use ready-mix concrete, complying with ASTM C94. Delivery tickets shall note the mix designation, admixtures, time dispatched, date, project number and Contractor and shall be submitted for review by IDOT.

- F. Testing: Contractor shall arrange for and pay for an independent testing laboratory, approved by IDOT, to perform the following tests; providing a copy of all reports to IDOT for approval:
1. Concrete sampling for design mix, air content and slump.
 2. Concrete cylinders for 7, 14, and 28 day compression strength.
 3. Conduct specified Source Quality Control and Field Quality Control and submit reports for all concrete work.
- G. Provide quality assurance according to Section 03 30 00 Cast in Place Concrete Article 3.23 Quality Control and Testing During Construction.
- H. See also Division 01, Testing.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store weather tight to provide protection from dampness and contamination.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Do not use frozen or partially frozen aggregate.
- C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

1.06 PROJECT CONDITIONS

- A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete performance.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials shall meet the following Articles of Section 1000 of IDOT SSRBC.

<u>Item</u>	<u>Section</u>
(a) Latex/Portland Cement Concrete (Note 1) (Note 2)	1020
(b) Packaged Rapid Hardening Mortar or Concrete	1018
(c) Concrete Curing Materials	1022.02

Note 1: The latex admixture shall be a uniform, homogeneous, non-toxic, film-forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture. The latex admixture shall not contain any chlorides and shall contain 46 to 49 percent solids.

The latex admixture shall be packaged and stored in containers and storage facilities which will protect the material from freezing and from temperatures above 85°F (30°C). Additionally, the material shall not be stored in direct sunlight

and shall be shaded when stored outside of buildings during moderate temperatures.

Note 2: Cement shall be Type I Portland cement. Fine aggregate shall be natural sand and the coarse aggregate shall be crushed stone or crushed gravel. The gradation of the coarse aggregates shall be CA 13, CA 14 or CA 16.

- B. Concrete sealer shall be BASF Hydrozo 100 Plus or approved equal.

2.02 MIXTURE DESIGN

- A. The latex concrete shall include the following constituent elements and meet stated performance requirements herein:

Type I Portland Cement

Latex Admixture

Coarse Aggregate - 42 to 50 percent by weight (mass) of total aggregate

Water (including free moisture on the fine and coarse aggregates)

No air entraining admixtures shall be added to the mix.

The latex concrete shall meet the following requirements:

Slump shall be according to Article and 1020.12: 3 to 6 in. (75 to 150 mm)

Air Content shall be according to Article and 1020.12: 7 percent maximum

Water-cement ratio (considering all the nonsolids in the latex admixture as part of the total water): 0.30 to 0.40

Compressive Strength (28 days): 4000 psi minimum

PART 3 EXECUTION

3.01 EQUIPMENT

- A. The equipment used shall be subject to the approval of IDOT and shall meet the following requirements:
1. Surface Preparation Equipment. Surface preparation equipment shall be according to the applicable portions of Section 1100 of the IDOT SSRBC and the following:
 - a. Sawing Equipment. Sawing equipment shall be a concrete saw capable of sawing concrete to the specified depth.
 - b. Hand-Held Blast Cleaning Equipment. Blast cleaning using hand-held equipment may be performed by high-pressure waterblasting or abrasive blasting. Hand-held blast cleaning equipment shall have oil traps. This equipment shall be capable of removing weak concrete at the surface, including any microfractured concrete at the surface.
 - c. Vacuum Cleanup Equipment. The equipment shall be equipped with fugitive dust control devices capable of removing wet debris and water all in the same pass. Vacuum equipment shall also be capable of washing

- the deck with pressurized water prior to the vacuum operation to dislodge all debris and slurry from the deck surface.
- d. Power-Driven Hand Tools. Power-driven hand tools will be permitted including jackhammers lighter than the nominal 45 lb. (20 kg) class. Jackhammers or chipping hammers shall not be operated at an angle in excess of 45 degrees measured from the surface of the slab.
2. Concrete Equipment: A mobile Portland cement concrete plant shall be used for Latex Concrete and shall be according to Articles 1020.12, 1103.04 of the IDOT SSRBC and the following:
 - a. The device for proportioning water shall be accurate within one percent.
 - b. The mixer shall be a self-contained, mobile, continuous mixer used in conjunction with volumetric proportioning.
 - c. The mixer shall be calibrated prior to every placement of material or as directed by IDOT.
 3. Finishing Equipment. Finishing equipment shall be according to Article 503.03 of the IDOT SSRBC.
 4. Mechanical Fogging Equipment. Mechanical fogging equipment shall be according to 503.03 of the IDOT SSRBC.

3.02 CONSTRUCTION REQUIREMENTS

- A. Station structural and architectural elements, reinforcement and/or existing transverse and longitudinal joints which are to remain in place shall be protected from damage during scarification and cleaning operations. All damage caused by the Contractor shall be corrected, at the Contractor's expense, to the satisfaction of IDOT.
- B. The Contractor shall control the runoff water generated by the various construction activities in such a manner as to minimize, to the maximum extent practicable, the discharge of untreated effluent into adjacent waters, and shall properly dispose of the solids generated according to Article 202.03 of the IDOT SSRBC. The Contractor shall submit a water management plan to IDOT specifying the control measures to be used. The control measures shall be in place prior to the start of runoff water generating activities. Runoff water shall not be allowed to constitute a hazard to adjacent or underlying roadways, waterways, drainage areas or railroads nor be allowed to erode existing slopes.

3.03 PANEL SURFACE PREPARATION

- A. Panel Surface Preparation. The precast panels shall be cleaned of all oil, grime and loose particles prior to application of the overlay.
- B. The precast deck panels shall be thoroughly vacuum cleaned in a timely manner before the water and debris are allowed to dry on the deck panels.

3.04 PRE-PLACEMENT PROCEDURE

- A. Prior to placing the overlay, IDOT will inspect the panel surface. All contaminated areas shall be blast cleaned again at the Contractor's expense.

3.05 PLACEMENT PROCEDURE

- A. Concrete placement shall be according to Article 503.07 of the IDOT SSRBC and the following:
 - 1. Bonding Method. The deck shall be cleaned to the satisfaction of IDOT and shall be thoroughly wetted and maintained in a dampened condition with water for at least 12 hours before placement of the overlay. Any excess water shall be removed by compressed air or by vacuuming prior to the beginning of overlay placement. Water shall not be applied to the deck surface within one hour before or at any time during placement of the overlay.
- B. Overlay Placement. Placement of the concrete shall be according to Article 503.16 of the IDOT SSRBC.
 - 1. Internal vibration will be required along edges, adjacent to bulkheads, and where the overlay thickness exceeds 3 in. (75 mm). Internal vibration along the longitudinal edges of a pour will be required with a minimum of 2 hand-held vibrators, one on each edge of the pour. Hand finishing will be required along the edges of the pour and shall be done from sidewalks, curbs or work bridges.
 - 2. A construction dam or bulkhead shall be installed in case of a delay of 30 minutes or more in the concrete placement operation.
 - 3. All construction joints shall be formed. When required by IDOT the previously placed overlay shall be sawed full-depth to a straight and vertical edge before fresh concrete is placed. IDOT will determine the extent of the removal. When longitudinal joints are not shown on the plans, the locations shall be subject to approval by IDOT and shall not be located in the wheel paths.
- C. Limitations of Operations
 - 1. Weather Limitations. Temperature control for concrete placement shall be according to 1020.14(b). The concrete protection from low air temperatures during the curing period shall be according to Article 1020.13(d) of the IDOT SSRBC. Concrete shall not be placed when rain is expected during the working period. If night placement is required, illumination and placement procedures will be subject to the approval of IDOT. No additional compensation will be allowed if night work is required.

3.06 JOINTS

- A. Construct joints in the overlay per the details shown in the Contract Drawings .
- B. Construct joint true and to line perpendicular to the surface plane of topping.

- C. Form weakened-plane contraction joints with power saws, 1/8 inch wide, when cutting action will not tear, abrade or otherwise damage surface and before overlay develops random contraction cracks.

3.07 CURING

- A. Curing. The minimum curing time shall be 48 hours of wet cure followed by 48 hours of dry cure. The wet cure shall be according to Article 1020.13(a)(5) of the IDOT SSRBC (Wetted Cotton Mat Method). When the cotton mats have been pre-dampened, excess water shall not be allowed to drip from the cotton mats onto the overlay during placement of the mats. After the wet cure is completed all layers of covering materials shall be removed to allow for the dry cure.
- B. If the ambient temperature falls below 50°F (10°C) during either the wet or dry curing periods, the time below 50°F (10°C) will not be included in the 96 hour curing period. If there is sufficient rain to wet the surface of the overlay for more than one hour of the dry cure period, the wet time will not be included in the 48 hour dry cure period.
- C. No pedestrian traffic or construction equipment will be permitted on the overlay until after the specified cure period and the concrete has obtained a minimum compressive strength of 2700 psi (18,400 kPa) or flexural strength of 450 psi (3,100 kPa) unless permitted by IDOT.

3.08 OVERLAY TESTING

- A. IDOT reserves the right to conduct pull-off tests on the overlay to determine if any areas are not bonded to the underlying concrete, and at a time determined by IDOT. The overlay will be tested according to the Illinois Test procedure 305 "Pull-off Test (Overlay Method)", and the Contractor shall provide the test equipment. Each individual test shall have a minimum strength of 150 psi (1,034 kPa). Unacceptable test results will require removal and replacement of the overlay at the Contractor's expense, and the locations will be determined by IDOT. When removing portions of an overlay, the saw cut shall be a minimum depth of 1 in. (25 mm).
- B. If the overlay is to remain in place, all core holes due to testing shall be filled with a rapid set mortar or concrete. Only enough water to permit placement and consolidation by rodding shall be used, and the material shall be struck-off flush with the adjacent material.
- C. For a rapid set mortar mixture, one part packaged rapid set cement shall be combined with two parts fine aggregate, by volume; or a packaged rapid set mortar shall be used. For a rapid set concrete mixture, a packaged rapid set mortar shall be combined with coarse aggregate according to the manufacturer's instructions; or a packaged rapid set concrete shall be used. Mixing of a rapid set mortar or concrete shall be according to the manufacturer's instructions.

3.09 CONCRETE SEALER

- A. All exposed overlay surfaces shall receive a coat of concrete sealer meeting the requirements of this specification. Surface preparation and application shall be in accordance with manufacture's recommendations.

END OF SECTION 03 31 10

SECTION 03 40 00
PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for precast structural concrete system. The work under this Section shall consist of furnishing all labor, materials, and equipment required to provide and install the precast structural concrete system, including hoisting and attachment plates and accessories, expansion joints, edge options, sealer, etc., at the locations shown on the drawings and as shown on the drawings, specified herein and as otherwise required for a complete installation including all accessories other appurtenant work required to complete this work.
- B. Related Sections: The following sections contain requirements that relate to this Section.
1. Section 03 10 10 – Latex Concrete Overlay
 2. Section 03 20 00 - Concrete Reinforcement Galvanized
 3. Section 03 30 00 - Cast-In-Place Concrete
 4. Section 07 90 00 - Joint Sealers

1.03 REFERENCES

- A. Precast and Prestressed Concrete Institute PCI MNL 116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- B. PCI MNL 120 –PCI Design Handbook –Precast and Prestressed Concrete
- C. Testing: In compliance with applicable provisions of Prestressed Concrete Institute PCI MNL 116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- D. Requirements for regulatory agencies: All local codes plus the following specifications, standards and codes are a part of these specifications:
1. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition.
 2. ACI 318 – Building Code Requirements for Reinforced Concrete.
 3. AWS D1.1 – Structural Welding Code.
 4. ASTM Specifications as referenced in Part 2 – Products of this Specification.
 5. Chicago Building Code.

1.04 PERFORMANCE REQUIREMENTS

- A. Design: Complete structural precast concrete system to be designed by a licensed structural engineer.
- B. Structural Performance: Structural precast concrete members, system, anchorage and connections to be designed to withstand, at a minimum, code dictated design loads including dead loads, live loads, seismic loads and vibration.

- C. Design Requirements: Design structural precast concrete system framing, anchorage and connections to maintain clearances at openings, allow for fabrication and construction tolerances, allow for live load deflection, shrinkage and creep of primary building structure and other building movements. Maintain structural precast concrete deflections within limits of ACI 318.
- D. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of minus 18 degrees F to plus 120 degrees F.

1.05 SUBMITTALS

- A. Submit, in accordance with Section 01 30 00, Submittals, shop drawings, product data and samples as required below:
 - 1. Product Data: For each type of product indicated.
 - 2. Design Mixtures: For each concrete mixture. Include compressive strength and water absorption tests.
 - 3. Erection Shop Drawings shall include:
 - a. Plans and/or elevations locating and defining all material to be furnished by the manufacturer.
 - b. Sections and details showing connections, anchorage devices, cast-in items and their relationship to the structure.
 - c. Description of all loose, cast-in and field hardware.
 - d. Field installation and/or location drawings.
 - e. Erection sequences and handling requirements.
 - f. All dead, live and other applicable loads used in the design.
 - g. Show welded connections by size, length and type of each weld.
 - 4. Production drawings shall include:
 - a. Elevation view of each member.
 - b. Sections and details indicating quantities and position of reinforcing steel, anchors, inserts, etc.
 - c. Erection and lifting inserts.
 - d. Dimensions and finishes.
 - e. Prestress for strand and concrete strengths.
 - f. Estimated Cambers.
 - g. Method of transportation.
 - h. Edge options.
 - i. Expansion joint details and materials.
 - j. Indicate joints, reveals and extent and location of each surface finish.
 - k. Size and location of openings.
 - 5. Product Data:
 - a. The Contractor shall submit design calculations that indicate conformance with the following design requirements:
 - 1) Initial handling and erection stresses.
 - 2) Indicate estimated camber.
 - 3) Indicate shim sizes and grouting sequence.
 - 4) All other loads specified for member where they are applicable.
 - 6. Erection drawings, production drawings and other shop drawings must be prepared by and certified by a Licensed Structural Engineer in the State of Illinois, experienced in precast prestressed concrete design and submitted for

- approval upon request.
7. Samples:
- a. Prior to fabrication of all the units, the Contractor shall provide a minimum of ten samples of precast concrete material as specified herein to determine an acceptable range of color and texture for the completed installed structural precast concrete components.
8. Mock ups:
- a. Cast and finish two (2) four foot square panel samples to be reviewed and approved by IDOT. Casting and finishing methods shall be the same as those to be used for the actual platform deck panels.
 - b. Provide mock-up of expansion joint.
 - c. Include detail for tactile edge.
 - d. Provide mock up of any optional edge details.
- B. Test reports: Reports of tests on concrete, aggregates and other materials.
- C. Certifications: Submit copies of current certifications in good standing from PCI for both the proposed fabricator of the structural precast concrete system and the proposed erector of the structural precast concrete components for IDOT's verification and approval prior to contracting with the respective subcontractor.
- D. Qualification Data: Provide information regarding experience for both the fabricator and installer of the structural precast concrete system.

1.06 QUALITY ASSURANCE

- A. Acceptable Manufacturers: A Company specializing in providing structural precast concrete products and services associated with the industry for at least five years. Written evidence shall be submitted documenting experience and plant adequacy to fulfill the contract requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer. The structural concrete pre-caster must be PCI certified.
- B. Installer qualifications: Regularly engaged for at least five years in the erection of precast structural concrete products similar to the requirements of this contract. Erector must have a PCI Certificate of Compliance to erect structural precast concrete of the type to be used on the project.
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Design Standards: Comply with ACI 318 and design recommendations in PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete", applicable to types of precast structural concrete units indicated.
- E. Quality Control Standard: For manufacturing procedures and testing requirements, quality control recommendations and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
- 1. AWS D1.1, "Structural Welding Code – Steel."
 - 2. AWS D1.4, "Structural Welding Code – Reinforcing Steel."

- G. Sample Panels: After sample approval and before fabricating structural precast concrete units, produce a minimum of each type of finished unit indicating architectural features, finishes, colors and textures for IDOT's review and approval.
- H. Mockups: After sample panel approval but before production of structural precast concrete members, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Mockup shall have actual architectural finish and be complete with anchors, connections, flashings and join fillers.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Authority specifically approves such deviations in writing.
 - 3. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion and approved by IDOT.
- I. Pre-installation Conference: Conduct conference at the Project Site according to the requirements set forth in Division One Section, "Project Meetings."

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Precast members shall be lifted and supported only at lifting or supporting points, or both, and with the approved lifting devices during manufacturing, stockpiling, transporting and erecting operations. All lifting devices shall have a minimum safety factor of 4.
- B. Storage:
 - 1. Minimize on-site storage of stockpiled materials.
 - 2. Store all units off ground.
 - 3. Place stored units so that identification marks are discernible.
 - 4. Separate stacked members by battens across full width of each bearing point.
 - 5. Stack so that lifting devices are accessible and undamaged.
 - 6. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

1.08 COORDINATION

- A. Coordinate work of this section with other subcontractors to verify required dimensions and locations including for inserts, anchors, anchor bolts, plates, conduit, and other items to be embedded in the concrete or installed with the concrete.
- B. Coordinate the delivery of embedded items or items to be installed with the precast concrete so as to avoid delays to the installation of the new work.
- C. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that work. Provide locations, setting diagrams, templates, instructions and directions, as required, for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fabricator of structural precast concrete system shall be certified by PCI and approved

by the Authority.

2.02 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement and configuration to produce precast members similar to approved samples. Furnish with manufacturer's recommended liquid release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.03 REINFORCING MATERIALS

- A. Galvanized Reinforcing Bars: ASTM A 615, Grade 60, deformed, ASTM A 767, Class II zinc coated, hot-dip galvanized.

2.04 PRESTRESSING TENDONS

- A. Pretensioning Strand: Galvanized 7-wire, ASTM A 416 – Grade 270K, low relaxation strand.

2.05 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, domestic brand, Type I, normal Portland Cement, gray unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand and mill source.
- B. Type III high early-strength Portland Cement may be used subject to approval of IDOT. All provisions of the specifications shall apply except that the 7 day compressive strength shall equal the 28 day strength required for normal concrete.
- C. The same brand of Portland Cement shall be used for exposed concrete throughout the project unless approved otherwise in writing by IDOT. Air entraining cement is not acceptable.
- D. Coarse Aggregate: ASTM C33.
- E. Fine Aggregate: ASTM C33.
- F. Water Reducing admixture: ASTM C494, Type A, "Pozzolith 322N" (Master Builders Co.) "WRDA" (W.R. Grace & Co.) or "Plastocrete 161" (Sika Chemical Corp.), or approved equal.
- G. Fly Ash: Should be used conforming to Section 1010 and Article 1020.05 of the IDOT Standard Specifications.

- H. Calcium Chloride: Shall not be used.
- I. Water: Potable; free from deleterious material that may affect color stability, setting or strength of concrete and complying with chemical limits of PCI MNL 116.
- J. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- K. Other Admixtures: Only as approved by IDOT.

2.06 STEEL CONNECTION MATERIALS

- A. Anchors and Inserts:
 - 1. Structural Steel Shapes and Plates: ASTM A36.
 - 2. Malleable Iron Castings: ASTM A47.
 - 3. Carbon-Steel Bolts and Studs: ASTM A 307.
 - 4. High-Strength Bolts and Nuts: ASTM A 325.
- B. Zinc-Coated Finish: All ferrous steel to be hot-dip galvanized per ASTM A 153.
 - 1. For steel shapes, plates and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2,5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing less than 94 percent zinc dust by weight and complying with DOD-P-21035B or SSPC-Paint 20.
- C. Welding Electrodes: Comply with AWS Standards.
- D. Precast Accessories: Provide clips, hangers, plastic or steel shims and other accessories required to install precast structural concrete units.

2.07 BEARING PADS

- A. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi, ASTM D 412.
- B. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly orientated synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no splitting, cracking or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
- C. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to stainless steel plate of type required for in-service stress.
- D. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.08 GROUT MATERIALS

- A. Grout shall be non-metallic, non-gaseous, non-shrink type in accordance with ASTM C 1107 and GRD-C 621, Corps of Engineers specification for non-shrink grout. Compressive strength of grout shall be a minimum of 7500 psi in accordance with ASTM C109. Duragrout (L&M Construction Chemical), NS Grout (Euclid) or set grout (Master

Builders Co.)

2.09 CONCRETE MIXES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Limit use of fly ash to 25 percent replacement of Portland cement by weight and granulated blast furnace slag to 40 percent of Portland cement by weight; metakaolin and silica fume to 10 percent of Portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 6000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- D. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.
- E. Use of calcium chloride, chloride ions or other salts will not be permitted.
- F. Maximum concrete slump shall be 3 inches.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- H. Other admixtures shall conform to ASTM C260 and be approved by IDOT.
- I. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, project conditions, weather, test results or other circumstances warrant.

2.10 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete- placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed precast structural concrete units of shapes, lines and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.11 FABRICATION

- A. Manufacturing procedures shall be in accordance with PCI MNL-116 and as necessary to

fulfill the requirements specified herein.

- B. Dimensional Tolerances of Finished Units: Comply with PCI MNL-116. Overall height and width measured at face adjacent to mold at time of casting:
1. 10 feet or under: plus or minus 1/8 inch.
 2. 10 feet to 20 feet: plus 1/8 inch and minus 3/16 inch.
 3. Out of square (difference in length of two diagonal measurements): 1/8 inch per 10 feet.
 4. Thickness: plus or minus 1/8 inch.
 5. Tolerances of other dimensions not otherwise indicated: plus or minus 1/16 inch per 10 feet.
- C. Slope or Bow: Provide camber as required to allow members to be plumb after installation compensating for deflection and depending upon actual span and loading. Provide any slope as shown on drawings for drainage.
- D. Position Tolerances: For cast-in items measured from datum line locations as shown on shop drawings.
1. Anchors and inserts: within 3/8 inch of centerline location.
 2. Blackouts and reinforcements: within 1/4 inch of position shown on the shop drawings.
 3. Bearing Plates: within 1/4 inch transverse (measured perpendicular to platform stringers) and 3/8 inch longitudinal (measured parallel to platform stringers) of position shown on the shop drawings.
- E. Built-in Items: Provide loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, hangers and other hardware shapes in units to receive attachments, securing precast structural concrete units to supporting and adjacent construction and other similar work as indicated below and as required by the Drawings.
1. Provide stainless steel or galvanized steel inserts and sleeves cast into units for attachment of loose hardware, connection of structural members or installation of miscellaneous components.
 2. Provide ASTM A36 steel bearing plates with welded studs cast into units for field attachment of the Precast Concrete members.
- F. Anchorages: Provide loose stainless steel, galvanized steel or primed steel items such as plates, shims, clip angles, seat angles, anchors, dowels, clamps, hangers and other miscellaneous steel shapes not provided by other trades, as necessary to secure precast unit to supporting and adjacent members as required by the drawings.
1. Cast-in Anchors, Inserts, Plates, Angles and other anchorage hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 2. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1 and AWS C5.4, "Recommended Practices for Stud Welding."
- G. Cast-in reglets, slots, holes and other accessories in precast structural concrete units as indicated on the drawings.
- H. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Authority's approval.

- I. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surface.
 - 3. Place reinforcing steel and prestressing strand to maintain at least $\frac{3}{4}$ -inch minimum coverage. Increase cover requirements according to ACI 318 when units are exposed to corrosive environment or severe exposure conditions. Arrange, space and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire ends away from finished, exposed concrete surfaces.
- J. Reinforce precast structural concrete units to resist handling, transportation and erection stresses.
- K. Prestress tendons for precast structural concrete units by either pretensioning methods. Comply with PCI MNL 116.
 - 1. Delay detensioning of precast, prestressed structural concrete units until concrete has reached its minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 4. Protect strand ends and anchorages with bituminous, zinc-rich or epoxy paint to avoid corrosion and possible rust spots.
 - 5. Protect strand ends and anchorages with a minimum of 1-inch thick, nonmetallic, nonshrink grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
- L. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting and placing concrete. After concrete batching, no additional water may be added.
- M. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- N. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- O. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.
 - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

- P. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- Q. Comply with PCI MNL 116 procedures for hot-weather concrete placement.
- R. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.
- S. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final project.
- T. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance and appearance unless repairs meet requirements in PCI MNL 116 and meet IDOT's approval.

2.12 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

2.13 FINISHES

- A. The color and surface texture of the precast concrete shall be similar for the entire project. All precast concrete members shall be supplied by the same precast manufacturer.
- B. Commercial Grade Finish:
 - 1. Remove fins, offsets and large protrusions and grind as needed to comply with item 4 in this section. Rub or grind ragged edges smooth. Grind smooth all form joints. Faces must have true, well-defined surfaces. Concrete surfaces to be smooth with exception of top surface, see item 4 in this section. Fill air holes greater than 1/8 inch in diameter and grind smooth. Repair surface blemishes due to holes or dents in molds. There should be no discoloration at form joints.
 - 2. Small surface holes caused by air bubbles, normal color variations, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycombing or other defects will be permitted.
 - 3. Minor indentations, minor chips and spalls will not be permitted. No major imperfections, honeycombing or other defects will be permitted.
 - 4. Top surface of precast panels shall be intentionally roughened in the shop to a minimum of 1/8" amplitude.
- C. Patching: Patching is not acceptable without the prior approval of IDOT. In no case shall the Contractor install patching that compromises the structural performance or appearance of the installed product.

2.14 SOURCE QUALITY CONTROL

- A. Testing Agency: Contractor shall engage and pay for an independent, qualified and approved by IDOT testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 - 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement and curing facilities. Cooperate with testing

agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

- B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements.
- C. Strength of precast structural concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, employ a qualified testing agency to obtain, prepare and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.
 - 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by IDOT.
 - 2. Cores will be tested in an air-dry condition.
 - 3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28 day design compressive strength and no single core is less than 75 percent of 28 day design compressive strength.
 - 4. Test results will be made in writing on same day that tests are performed, with copies to IDOT, Contractor and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name and type of precast concrete units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances and color and texture range. Chipped, spalled or cracked units may be repaired, subject to IDOT's approval. IDOT reserves the right to reject precast units that do not match approved samples and mockups.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces and other conditions affecting performance of the work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place, building structural

framing has attained minimum allowable design compressive strength or until supporting steel or other structure is complete.

- D. Precast panel supplier shall inspect and approve support structure for precast panels. Verify dimensions and location and size of openings. Any discrepancies between approved shop drawings and actual installation shall be resolved prior to installation of the panels.

3.02 PREPARATION

- A. The Contractor shall be responsible for providing true, level bearing surfaces on all field placed bearing walls and other field constructed supporting structures.
- B. The Contractor shall be responsible for the placement and accurate alignment of anchor bolts, plates, stringers, required shim plates and other field constructed supporting members. Coordinate with the precast supplier.

3.03 PLACEMENT

- A. Placement of the precast concrete structural members shall be coordinated with adjacent elements of construction to assure proper installation, bearing and conformance with the requirements for tolerances.

3.04 INSTALLATION

- A. Installation: Installation of the Precast Structural Concrete members shall be performed by a competent erector approved by the manufacturer. Members shall be lifted by means of suitable lifting devices at points provided by the manufacturer. Temporary shoring and bracing, if necessary, shall comply with the manufacturer's recommendations.
- B. Install clips, hangers, bearing pads and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- C. Alignment: Members shall be properly aligned and leveled as required by the approved shop drawings. Variations between adjacent members shall be within the tolerances specified in PCI MNL-116 and limits of erection tolerances specified herein.
- D. Erect precast structural concrete level, plumb and square within specified allowable tolerances. Provide temporary structural framing, supports and bracing as required to maintain position, stability and alignment of units until permanent connection.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
- E. Connect precast structural concrete units in position by bolting, welding, grouting or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges and spacers as soon as practical after connecting and grouting are completed.
- F. Field cutting of precast units is not permitted without approval of IDOT.
- G. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

- H. Welding: Comply with applicable AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds and methods used in correcting welding work.
1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 2. Clean weld-affected steel surfaces with chipping hammer followed by brushing and applying a minimum 4.0 mil thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
 3. Clean weld-affected steel surfaces with chipping hammer followed by brushing and reprime damaged painted surfaces.
 4. Remove, reweld or repair incomplete and defective welds.
- I. Grouting: Grout connections and joints and open spaces at keyways, connections and joints where required or indicated on Shop Drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled.
1. Place grout to finish smooth, level and plumb with adjacent concrete surfaces.
 2. Fill joints completely without seepage to other surfaces.
 3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
 4. Place grout end cap or dam in voids at ends of hollow-core slabs.
 5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 6. Keep grouted joints damp for not less than 24 hours after initial set.

3.05 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, true and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. The precast concrete structural concrete members shall be fabricated and erected such that when assembled they shall be in perfect alignment, however, a deviation of plus or minus 1/8 inch will be acceptable unless shown or required otherwise.

3.06 CONTROL JOINTS

- A. Joints between adjacent precast structural concrete members and between precast structural concrete members and supporting and/or adjacent structures shall be filled with pre-molded joint filler, backer rod and sealant as shown on the drawings.
- B. The precast structural concrete members shall be fabricated and erected such that when assembled the joints between members shall be 3/8 inch in width within the tolerance of plus or minus 1/16 inch; unless shown otherwise on the drawings or required otherwise by the manufacturer.

3.07 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor to engage and pay for a qualified and approved inspector and testing agency to inspect the erection of the precast structural concrete members and perform tests.
- B. Field welds will be visually inspected and nondestructive tested according to ASTM E 165 or ASTM E 709. High strength bolted connections will be subject to inspections.
- C. Testing agency will report test results promptly and in writing to Contractor and IDOT.

- D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.08 INSPECTION

- A. The precast concrete structural members will be field inspected by IDOT. Units with chipped, spalled or cracked concrete will be rejected. Visible chips larger than 1/8 inch deep, 1/2 inch wide and 3/4 inch long will be rejected. All such cracks and surface defects not meeting the approval of IDOT shall be repaired or replaced by the Contractor at no expense to IDOT and no delay to the completion of the work.

3.09 REPAIRS

- A. Repair precast structural concrete units if permitted by IDOT.
 - 1. Repairs may be permitted if structural adequacy, serviceability, durability and appearance of units has not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by IDOT.

3.10 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 40 00

SECTION 03 61 11
NON-SHRINK GROUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections, apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for furnishing all labor, materials, and equipment required to provide and install the grout as shown on the drawings and as required including surface preparation and all other appurtenant work and items required to complete this work; including the following:

1. Cementitious Grout.
2. Epoxy Grout.
3. Epoxy Adhesive.

- B. Related Sections: The following sections contain requirements that relate to this Section.

1. Section 03 30 00 - Cast-in-Place Concrete
2. Section 04 80 00 - Unit Masonry
3. Section 05 10 30 - Structural Steel

1.03 DEFINITION

- A. For the purpose of these specifications, "non-shrink grout" shall be defined as a high-strength mortar or grout which does not shrink in the plastic state, is dimensionally stable in the hardened state, and bonds permanently to a clean metal baseplate and concrete substrate.

1.04 REFERENCES

- A. American Concrete Institute (ACI):

1. ACI 503.2 Specification for Bonding Plastic Concrete to Hardened Concrete with a multi-Component Epoxy Adhesive.

- B. American Society for Testing and Materials (ASTM):

1. ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
2. ASTM C157 Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
3. ASTM C579 Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
4. ASTM C827 Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
5. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
6. ASTM C1090 Test Method for Measuring changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.
7. ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement grout (Non-

shrinkable).

C. U.S. Army Corps of Engineers, Concrete Research Division (CRD):

1. CRD-C620 Standard Method of Sampling Fresh Grout.
2. CRD-C621 Non-shrink Grout.

1.05 SUBMITTALS

A. Submit, for the grout provided, in accordance with Section 01 30 00, Submittals, for the Authority's review and approval, the following:

1. Manufacturer's product data.
2. Manufacturer's installation instructions and recommendations including mixing, surface preparation and temperature considerations.
3. Manufacturer's Safety Data Sheets (MSDS) for the grout.
3. Recommended storage requirements and product life.
4. Product testing methods and conformity to ASTM standards.
5. Curing requirements and recommendations.

B. Certification: Submit certificates of compliance or laboratory test reports which indicate the following:

1. Materials used in the grout are free from metallic components and corrosion-producing elements.
2. Materials meet specified shrinkage and compressive strength requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage or contamination.

1.07 PROJECT CONDITIONS

A. Ensure that substrate ambient air and surface temperatures are 40 degrees F. within 24 hours of placement.

B. Do not apply if rain is imminent.

C. Protect from conditions that may cause early water loss: high winds, low humidity, high temperature, direct sunlight.

D. Grout will set faster at higher temperatures and slower at lower temperatures.

E. Follow manufacturer's recommendations regarding additional installation information (Standard on Hot Weather Concreting, ACI 305-R89 or Standard on Cold Weather Concreting", ACI 306-R88).

1.08 COORDINATION

A. Coordinate work of this section with other subcontractors to verify required dimensions and locations including for other items to be installed with the grout.

- B. Coordinate the delivery of items to be installed with the grout so as to avoid delays.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cementitious Grout: Provide non-shrink, non-metallic, non-corrosive cement-based grout conforming to the following requirements:
 - 1. Applicable Standards: ASTM C1107 and CRD-C621.
 - 2. Grout shall be manufactured specifically for use in supporting heavy loads (loads in excess of 300 pounds per square foot concentrated load or 100 pounds per square foot uniform load). Grout: ASTM C1107, Grade A, B, or C, as appropriate for the condition or circumstance.
 - 3. Shrinkage at 28 days: No shrinkage before hardening (0.00 shrinkage when tested in accordance with ASTM C827); no shrinkage after hardening (0.00 shrinkage when tested in accordance with CRD-C621).
 - 4. Compressive strength, minimum:
 - a. At one day: 1000 psi
 - b. At three days: 2500 psi
 - c. At seven days: 3500 psi
 - d. At 28 days: 5000 psi
 - 5. Initial setting time, after addition of water: approximately one hour at 70 degrees F.
 - 6. Provide nonsag trowelability or flowability as necessary for the particular application.
- B. Water: Clean and potable, free of impurities detrimental to grout.
- C. Epoxy Grout: Provide non-shrink, non-metallic, non-corrosive epoxy grout conforming to the following requirements:
 - 1. Grout shall be manufactured specifically for use in supporting heavy loads.
 - 2. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTM C827 modified procedure) with a minimum effective bearing area (EBA) of 95 percent coverage of the tested base plate.
 - 3. Compressive strength, minimum: 10,000 psi at seven days, when tested in accordance with ASTM C579.
 - 4. Initial setting time: Approximately one hour at 70 degrees F.
 - 5. Provide flowable consistenancy as necessary for the particular application.
 - 6. Epoxy grouts which are volatile and which give off noxious fumes are not acceptable.
- D. Epoxy Adhesive: ASTM C881, Type V, epoxy-based bonding agent.

2.02 MIXING

- A. Mix grout ingredients for both cementitious grout and epoxy grout in accordance with the respective manufacturer's mixing instructions and recommendations. Mix grout materials in proper mechanical mixers.
- B. Mix grout as close to work area as possible.

2.03 SOURCE QUALITY CONTROL

- A. Inspections and tests: Perform visual inspections and shrinkage tests using an approved independent testing laboratory, and strength tests as necessary to verify performance requirements of grout. Sampling and testing of grout shall conform with applicable ASTM or CRD- C620 requirements.
- B. Visual Inspections: Perform visual inspection of the grout mixing and placement to determine and verify grout consistency, slump and stiffness are appropriate and proper for the location and type of installation.
- C. Shrinkage Tests:
 - 1. Cementitious Grout: Grout shall meet the following performance requirements:
 - a. Expansion: 0.4 percent maximum at 3, 14 and 28 days. Grout shall exhibit no displacement when tested in accordance with ASTM C157.
 - b. Shrinkage: None (0.00 shrinkage at 28 days when tested in accordance with ASTM C827 and ASTM C1090). There shall be no vertical volume shrinkage of grout in the plastic or hardened stage at any time.
 - 2. Epoxy Grout: Grout shall meet the following performance requirements:
 - a. Expansion: Grout shall exhibit no displacement when tested in accordance with
ASTM C827 and ASTM C157, modified procedures.
 - b. Shrinkage: None (0.00 shrinkage when tested in accordance with ASTM C827, modified procedure; specific gravity of indicator ball will be changed to approximately 1.0).
 - c. Effective Bearing Area: 95 percent minimum coverage of the tested base plate. D. Strength Tests: Compressive strength of grout shall meet the following requirements:
 - 1) Cementitious Grout: 5,000 psi minimum at 28 days when tested in accordance with ASTM C109.
 - 2) Epoxy Grout: 10,000 psi minimum at 7 days when tested in accordance with ASTM C579.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Concrete surfaces to receive grout shall be prepared by chipping, sandblasting, waterblasting or other accepted methods to remove defective concrete, laitance, dirt, oil, grease and other foreign matter to achieve sound, clean concrete surfaces. Lightly roughen concrete for bond, but not enough to interfere with proper placement of grout.
- B. Cover concrete areas with protective waterproof covering until ready to place grout.
- C. Remove foreign matter from steel surfaces to be in contact with grout. Clean contact steel surfaces as necessary by wire brushing and wiping dust clean.
- D. Align and level components to be grouted and maintain in final position until grout placement is complete and accepted.
- E. Install forms for grout around the column base plates and other spaces to be grouted.

The tops of such forms shall be one inch above surfaces to be grouted.

- F. Remove protective waterproof covering and clean contaminated surfaces immediately before grouting.
- G. Provide air-relief holes in large baseplates and in baseplates where underneath obstructions may cause air entrapment.
- H. Saturate concrete surfaces with clean water and remove excess water immediately before grouting.
- I. Where necessary or appropriate for better bond, epoxy adhesive may be applied to clean, dry substrate surfaces in accordance with applicable requirements of ACI 503.2.

3.02 PLACING GROUT

- A. Place grout in accordance with the manufacturer's installation instructions and recommendations. Pour grout from one side only until grout rises at least one inch above the plate on the opposite side of said plate. Strapping and plunging or other recommended method may be used to force grout to flow under the entire area.
- B. Neatly trowel edges of grout base, tapered at an angle of 60 degrees when measured from the horizontal or as indicated. Provide dry-pack cementitious grout where additional grout is required for shoulders.
- C. Do not remove leveling shims for at least 48 hours after grout has been placed.
- D. After shims have been removed, if used, fill voids with grout, packing the material with a suitable tool.
- E. Do not use grout which has begun to set or if more than one hour has elapsed after initial mixing.

3.03 CURING

- A. Cementitious grout shall be cured the same as specified for concrete.
- B. Epoxy grout shall be cured as recommended by the grout manufacturer.
- C. Do not remove forms until grout is sufficiently hard to avoid sagging or damaging.
- D. Wet cure the grout until the forms are stripped. Cure exposed material following placement using wet burlap for 48 hours.

END OF SECTION 03 61 11

SECTION 04 21 50
STRUCTURAL GLAZED FACING TILE

PART 1 GENERAL

1.01 SUMMARY

- A. Description: This Section includes:
1. Structural clay facing tile units.
 2. Mortar and grout.
 3. Reinforcement, anchorage, and accessories.
- B. Related Sections:
1. Section 07 60 00, Flashing and Sheet Metal.
 2. Section 07 90 00, Joint Sealants.

1.02 REFERENCES

- A. ASTM A 82-02 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcements.
- B. ASTM A 153/A153M-04 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A 1008/A1008M 04b - Standard Specification for Steel, Sheet, Cold – Rolled, Carbon Structural, High-Strength Low Alloy and High – Strength low Alloy with Improved Formability.
- D. ASTM A 653/A653M-04a - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated Galvanized. By the Hot Dipped Process.
- E. ASTM A 615/A615M-04b - Standard Specification for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.
- F. ASTM A 767/A 767M-00 b - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2000.
- G. ASTM C 126-99 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; 1999.
- H. ASTM C 144-03 - Standard Specification for Aggregate for Masonry Mortar.
- I. ASTM C 150-04ae1 - Standard Specification for Portland Cement.
- J. ASTM C 207-04 - Standard Specification for Hydrated Lime for Masonry Purposes.
- K. ASTM C 270-04a - Standard Specification for Mortar for Unit Masonry.
- L. ASTM C 404-04 - Standard Specification for Aggregates for Masonry Grout.
- M. ASTM C 476-02 - Standard Specification for Grout for Masonry; 2002.
- N. ASTM C 652-04 a - Standard Specification for Hollow Brick (Hollow Masonry Units Made

from Clay or Shale).

- O. ASTM D 226-97a - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 1997.
- P. ASTM D 1056-00 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber; 2000.
- Q. ASTM E 119-00 a. - Standard Test Methods for Fire Tests of Building Construction and Materials; 2000.

1.03 SUBMITTALS

- A. Product Data: Submit published data from manufacturers of products and accessories specified, indicating compliance with requirements.
 - 1. Ceramic glazed structural clay facing tile.
 - 2. Mortar.
- B. Samples:
 - 1. Ceramic glazed structural facing tile: Submit full size samples of each type of tile unit indicating each combination of color, texture and finish for approval. Submit full range of variations within each color specified for Commissioner's review and approval.
 - 2. Mortar: Submit full nominal 8"x8"x4" available manufactured samples of each type of mortar color, texture and finish for Commissioner's selection and approval.

1.04 QUALITY ASSURANCE

- A. Contractor's Quality Assurance Responsibilities: Contractor is responsible for quality control of the work. Comply with the requirements specified in Section 01400, Quality Control. Contractor shall retain inspector to review installed Structural Glazed Facing Tile for compliance with specified construction tolerances.
- B. Fire Ratings: Where fire-rated masonry construction is indicated or required, provide materials and construction methods identical to those of assemblies tested in accordance with ASTM E 119-00a for hourly ratings required. Provide evidence acceptable to governing authority that proposed construction complies with fire performance requirements.
- C. Source Control: Obtain exposed masonry units from one manufacturer, with texture and color uniform or of a uniform blend acceptable to the Commissioner.
- D. Upon commencement of exposed masonry work, the contractor shall erect a portion of the permanent wall to serve as the standard of appearance and workmanship throughout construction period.
 - 1. Adjust until appearance and workmanship are acceptable to the Engineer.
 - 2. Include each different type and color of structural glazed facing tile, and include each different type and color of mortar in its correct relationship to the tile.
 - 3. The manufacturer's representative shall be present for construction of the initial segment of the permanent wall.

1.05 DELIVERIES, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means, which shall prevent mechanical damage and deterioration due to moisture, temperature changes, and contamination by other materials.
 - 1. Handle and store structural clay facing tile units in protective cartons or trays. Do not remove from protective packaging until units are installed.
- B. Protect cementitious materials from precipitation and absorption of ground moisture.
- C. Store masonry accessories to prevent corrosion, dirt accumulation, and other deterioration.

1.06 PROJECT CONDITIONS

- A. Construction Protection: Cover tops of incomplete masonry elements with waterproof sheet material at end of each workday and when masonry work is not under way.
 - 1. Secure weather protection in place with weights or by use of temporary fasteners.
 - 2. Immediately remove mortar, soil, and other such materials from exposed masonry faces to prevent staining.
 - 3. Prevent splashing and soiling of masonry near ground level by spreading sheet material to cover soil or masonry faces.
 - 4. Protect horizontal masonry elements from mortar droppings.
- B. Cold Weather Protection: Do not lay masonry units when outside air temperature is below 40 degrees F.
 - 1. Grouted construction: On any day when minimum anticipated nighttime temperature is 32 degrees F or less, in addition to complying with general procedures above, heat grout materials to 90 degrees F to produce in-place grout temperature of not less than 70 degrees F at end of work day. Retain protective blankets or enclosures for not less than 48 hours.
 - a. Period of protection may be reduced to 24 hours when Type III Portland cement is used for grout.
 - 2. Clay masonry units: Comply with the following requirements for clay masonry units which must be wetted before laying because of initial rate of absorption (suction) greater than 1 gram per square inch per minute (ASTM C 67-03a):
 - a. Surface temperatures above 32 degrees F: Sprinkle with water heated to 70 degrees F or above, just before laying.
 - b. Surface temperatures below 32 degrees F: Sprinkle with water heated to 130 degrees F or above, just before laying.
 - 3. Water: do not heat water for mortar or grout to more than 160 degrees F.
- C. Hot-Weather Protection: Cover or shade masonry units and mortar materials and use cool water for mortar whenever ambient air temperature is 90 degrees F or greater. At air temperatures of 85 degrees F or above, if relative humidity is less than 30 percent or wind is in excess of 15 miles per hour, provide protection by immediately covering newly constructed walls, by providing windbreaks, or by using fog spray to reduce rate of evaporation.

PART 2 PRODUCTS

2.01 STRUCTURAL CLAY FACING TILE UNITS

- A. Ceramic Glazed Structural Clay Facing Tile for Exterior Use: Provide units which comply with requirements of ASTM C 652-04a, Grade SW, Type HBX for body performance and with requirements of ASTM C 126-99, Grade S sized for 3/8" mortar joints for ceramic finish and dimensional tolerances, and as follows:
1. Provide the following:
 - a. Elgin-Butler Brick Company, "4W series Structural Glazed Units".
 - b. Glen-Gery Corporation.
 - c. Stark Ceramics, Inc.
 - d. Belden Brick Co.
 - e. D'Hanis Brick and Tile Co.
 2. Glaze color and texture:
 - a. Provide and install three custom formulated colors as selected by the Commissioner, matte glaze finish.
 3. Sizes: As indicated on the drawings.
 4. Pattern: As directed by the Commissioner.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement, Mortar Cement, Masonry Cement, and Lime:
1. Laticrete International, Inc.
 2. Mapei Corporation.
 3. Essroc Materials, Inc.
 4. Glen-Gery Corporation.
 5. Lafarge Corporation.
 6. Lehigh Portland Cement Co.
 7. Riverton Corporation (The).
- B. Portland Cement: ASTM C 150-04ae1, Type I.
1. Type III may be substituted during cold-weather construction.
- C. Hydrated Lime: ASTM C 207-04, Type S.
- D. Aggregate for Mortar: ASTM C 144-03.
1. White mortar aggregates: Sand or ground stone.
 2. Colored mortar aggregates: Ground stone, in colors required to match commissioner's sample.
- E. Epoxy Pointing Mortar: ASTM C 395-01, epoxy-resin-based material formulated for use as pointing mortar for, and approved by manufacturer of, structural clay tile facing units; in color indicated or, if not otherwise indicated, as selected by the Commissioner from manufacturer's standard colors.
1. Products:
 - a. Hydroment epoxy mortar, "Color-Epoxy"
 - b. Laticrete, "Latapoxy SP100" vertical grade.

2. Joint Filler: Must be red at the vertical joints of the red SGFT. Red must match color of the red SGFT.
 3. U.N.O., pointing mortar color must match the color of the adjacent structural glazed facing tile.
- F. Provide manufacture standard color required to produce approved mortar sample. Submit full available standard colors to be selected by the Commissioner.
1. Design base on LATICRETE '#89 Smoke Grey' and '#22 Midnight Black'
- G. Water: Potable.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Bars: ASTM A 615/A615M-04b, Grade 60, deformed, except as specifically indicated otherwise.
1. Bending: Shop-fabricate reinforcing bars which are shown to be bent or hooked.
 2. Galvanized reinforcing bars: ASTM A 767/A767M-00b, Class II, hot-dip galvanized after fabrication and bending.
 - a. When bars are cut after galvanizing, coat the sheared ends with a zinc-rich coating.
- B. Joint Reinforcement and Anchorage Materials: Comply with the following general requirements for materials required in joint reinforcement and anchorage devices.
1. Steel wire: ASTM A 82-02.
 - a. Hot-dip galvanizing (after fabrication): ASTM A 153/A153M-04, Class B-2.
 - 1) Use: Exterior locations or in contact with earth.
 2. Zinc-coated steel sheet: ASTM A653/A653M carbon steel, with G90 zinc coating.
 - a. Use: Dovetail slots and similar applications.
 3. Hot-dip galvanized steel sheet: ASTM A 635/A635M-04e1 or ASTM A 1008/A1008M; galvanizing in compliance with ASTM A 153/A153M-04, Class B.
 - a. Use: Anchors and miscellaneous sheet metal in masonry accessories at exterior exposures.
 4. Manufacturers: Provide products complying with requirements of the contract documents and made by one of the following:
 - a. AA Wire Products Company.
 - b. Dur-O-Wal, Inc.
 - c. Heckman Building Products, Inc.
 - d. Hohmann and Barnard, Inc.
 - e. Masonry Reinforcing Corporation of America.
 - f. National Wire Products Industries, Inc.
- C. Joint Reinforcement: Welded-wire units prefabricated into straight lengths of not less than 10 feet, with deformed continuous side rods and plain cross rods.

1. Width: Approximately two inches less than nominal wall width, providing not less than 5/8 inch mortar coverage on exterior exposures and 1/2 inch elsewhere.
 2. Wire sizes:
 - a. Side rod diameter: 0.1483 inch.
 - b. Cross rod diameter: 0.1483 inch.
 3. Configuration:
 - a. Applications of single unit width: Ladder design, cross rods at not more than 16 inches on center.
 - b. Applications of more than one unit width: Truss design, diagonal cross rods at not more than 16 inches on center, and number of side rods as follows:
 - 1) One rod per face shell of concrete masonry.
 - 2) One rod per face shell of vertically cored structural clay face tile units, and not less than one rod per wythe of horizontally core units.
 - 3) Not less than 1 rod per brick wythe.
 - c. Applications of more than one unit width: Tab design, with single pair of side rods and U-shaped cross rods at not more than 16 inches on center.
 - 1) Use units with adjustable U-shaped tabs where horizontal joints of backup do not align with those of facing masonry.
 - d. Corners: Prefabricated L- and T-shaped units.
- D. Flexible Anchors: 2-piece anchors permitting vertical or horizontal differential movement between masonry and structural frame but preventing lateral movement of masonry out of plane.
1. For concrete framework, provide dovetail anchor sections formed from 12 gage sheet metal, and triangular wire ties 0.1875 inch thick; size ties to fall no more than 1 inch short of masonry face.
 - a. Furnish dovetail slots of sizes indicated, with filler strips, fabricated from not less than 22 gage sheet metal, for installation under Division 3.
 2. For steel framework, provide crimped wire anchor section 0.25 inch thick for welding and triangular wire tie 0.1875 inch thick; size ties to fall no more than 1 inch short of masonry face.
- E. Masonry Veneer Anchors: 2-piece anchors permitting vertical or horizontal differential movement between masonry and structural backup but preventing lateral movement of masonry out of plane.
1. Anchor plate design: Manufacturer's standard, of not less than 12 gage metal and designed for connection to structural backup through sheathing by not fewer than 2 fasteners.
 - a. Tie vertical adjustment range: Not less than 2 inches.
 2. Tie: Wire tie, as follows:

- a. 9 ga. 0.1483 inch.
 - b. Shape: Triangular or trapezoidal.
 - c. Length: Sized to fall no more than 1 inch short of veneer face.
3. Fasteners: Self-drilling, self-tapping, corrosion-resistant screws, as recommended by manufacturer of veneer anchors.

2.04 CONCEALED FLASHING MATERIALS

- A. Stainless Steel Flashing: Minimum 24 GA (0.024 inch) thick.

2.05 MISCELLANEOUS MASONRY ACCESSORIES

- A. Expansion Joint Strips: Neoprene filler strips complying with ASTM D 1056-00, Classification 2 A1, capable of 35 percent compression and sized for specific conditions indicated.
- B. Bond Breaker Strips: ASTM D 226-97a, Type I; No. 15 asphalt felt.
- C. Plastic Weep Hole/Vent: One-piece, flexible extrusion manufactured from ultraviolet-resistant polypropylene copolymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch (3 mm) from exterior face of masonry, in color selected from manufacturer's standard.
- D. Cavity Drainage Material: Reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.
1. Product: Subject to compliance with requirements, provide "Mortar Net" by Mortar Net USA, Ltd.
- E. Sealant and Backer Rod: As specified in Division 7.

2.06 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures unless indicated as acceptable in the contract documents.
1. Do not use calcium chloride in mortar or grout mixture.
- B. Mixing: Use mechanical batch mixer and comply with referenced ASTM standards.
- C. Mortar for Unit Masonry: ASTM C 270-04a, Proportion Specification.
1. Limit cementitious materials to lime and portland cement.
 2. Reinforced masonry: Type S.
 3. Applications as follows: Type N.
 - a. Exterior, above-grade walls.
 - b. Locations for which another mortar type has not been specifically indicated.
- D. Mortar Colored with Aggregates: Produce required mortar color by use of colored aggregates in combination with selected cementitious materials.
- E. Mortar Colored with Pigments: Proportion selected pigments with other ingredients to produce required color. Do not exceed ratio of pigment-to-cement recommended by

pigment manufacturer

- F. Grout: ASTM C 476-02: Provide necessary consistency required at time of placement to fill completely all spaces indicated to be grouted
- G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions

PART 3 EXECUTION

3.01 INSTALLATION PROCEDURES

- A. Clay masonry: Before laying, wet clay masonry with initial absorption rate of more than 1 gram per square inch per minute, when measured in accordance with ASTM C 67-03a, using technique that shall saturate clay masonry but leave it dry to the touch.
- B. Reinforcement and Anchorage: Before placing metal masonry accessories, remove loose rust, dirt, and other coatings.
- C. Masonry Thickness: Build masonry elements to full thickness shown.
 - 1. Build single-wythe walls to actual thickness of masonry units.
- D. Chases and Recesses: Build masonry to accommodate the work of other trades, including chases and recesses as shown or required. Provide not less than 8 inches of masonry between jambs of openings and chases and recesses.
- E. Openings for Equipment and Services: Leave openings in masonry as required for subsequent installation of equipment and services. Make openings in designated locations and in exact size required, if known; otherwise, leave rough openings in approximate size required and complete masonry work after installation of equipment, matching adjoining masonry.
- F. Cutting: Where cutting is required, use continuous rim wet cutting diamond blade to provide clean, sharp, unchipped edges.

3.02 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: Do not exceed the following construction tolerances in vertical elements, including surfaces of walls, columns, and arises:
 - 1. 1/4 inch in 10 feet.
 - 2. 3/8 inch in one story height, or 20 feet, whichever is less, except 1/4 inch for external corners, expansion joints, and other highly conspicuous vertical elements.
 - 3. 1/2 inch in 40 feet or more.
 - 4. Plus or minus 1/4 inch in 10 feet, 1/2 inch maximum, for vertical alignment of head joints.
- B. Variation from Level: Do not exceed the following construction tolerances for bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal elements:
 - 1. 1/4 inch in one bay or in 10 feet maximum.
 - 2. 1/2 inch in 20 feet or more.

- C. Variation from Plan Lines: Do not exceed the following horizontal construction tolerances for related portions of columns, walls, and partitions:
1. 1/2 inch in any bay or in 20 feet maximum.
 2. 3/4 inch in 40 feet or more
- D. Variation in Cross Section: Do not exceed the following construction tolerances for thickness of walls and other masonry elements:
1. Minus 1/4 inch.
 2. Plus 1/2 inch.
- E. Variation in Mortar Joint Thickness: Do not exceed the following construction tolerances for thickness of mortar joints:
1. Bed joints: Plus or minus 1/8 inch over three consecutive tiles.
 2. Head joints: Minus 1/4 inch, plus 3/8 inch over three consecutive joints.

3.03 MASONRY CONSTRUCTION - GENERAL

- A. Layout: Lay out masonry for accurate pattern bond, for uniform joint widths, and for accurate location of specific features before beginning actual construction. Avoid use of masonry units of less than 1/2 size. Do not use units with less than nominal 4 inch horizontal face dimensions at corners and jambs.
- B. Pattern Bond: Lay exposed masonry in stack bond except where other bonds are indicated at special features.
1. Lay concealed masonry in running bond, or lap units at least 2 inches.
 2. Interlock wythes at corners and offsets in each course with masonry bond.
- C. Stopping Work: Lay masonry in proper sequence to avoid toothing. Rack walls back in each course at end of each work day. Before resuming, clean exposed surfaces and remove loose masonry units and mortar.
1. Lightly wet previously laid clay masonry units which have rate of absorption no more than 1 gram per square inch per minute (ASTM C 67-03a), before laying fresh masonry.
- D. Built-in Work: As work progresses, build in items indicated for installation in masonry, filling around built-in items solidly with masonry.
1. Fill joints between masonry and metal frames solidly with mortar, unless specific conditions are otherwise detailed.
- E. Expansion and Control Joints: Build in movement joints where indicated, installing accessory items as masonry is constructed.
1. Install non-elastic joint fillers as indicated.
 2. Create pressure-relieving joints beneath supports for masonry veneer, either leaving completely open for subsequent installation of backer rod and sealant, or installing compressible filler material as backing for sealant.
 3. At maximum 45'-0" spacing in same plane of wall.
 4. Where joints occur in construction supporting the masonry wall
 5. Where masonry wall abuts dissimilar construction or a structural element such as a column.
 6. Where a change occurs in masonry wall height or thickness and at chases and

recesses in the masonry wall.

- F. Lintels: Install lintels of types indicated at all openings.
 - 1. Bearing: Provide not less than 8 inches of bearing at each jamb.
 - 2. Reinforcement: At masonry openings greater than one foot in width, install horizontal joint reinforcement in 2 courses immediately above lintel and 2 courses immediately below sill. Except at control joints, install opening reinforcement to extend not less than 24 inches beyond jamb on each side.

3.04 LAYING MASONRY UNITS

- A. Hollow Masonry Units: Install so that face shells are solidly mortared, horizontally and vertically. Bed webs solidly in mortar at all courses.
- B. Joints: Make mortar joints visually and dimensionally consistent.
 - 1. Except as otherwise indicated, maintain mortar joint widths of 3/8 inch.
- C. Concealed Joints: Cut flush, unless otherwise detailed.
- D. Exposed Joints: Using 1" diameter striker, not metal, tool exposed joints before mortar has assumed final set.
- E. Resetting: Do not pound, tap, or otherwise attempt to adjust masonry units after initial set has occurred. Remove units which require adjusting, clean thoroughly, and reset in fresh mortar.
- F. Fill collar joints between wythes solidly with mortar as each course is laid for all multi-wythe applications except designated cavity walls.
- G. Cavities: Keep clear of mortar droppings and strike flush mortar joints facing cavity.
- H. Use wet cutting continuous rim diamond blade for all cuts.
- I. Pointing:
 - 1. Rake joints out to a depth of 3/8".
 - 2. Point with epoxy mortar. Tool all pointed joints with a 1" diameter striking tool which is not metal. Clean tile after pointing and leave no film on the face of the tile.

3.05 CAVITY WALL CONSTRUCTION

- A. Horizontal Joint Reinforcement: Install continuously in bed joints at 16 inches on center vertically to bond wythes of cavity walls, lapping individual sections at least 6 inches. Use prefabricated L-shaped and T-shaped sections at corners and intersections. Do not span movement joints with reinforcement.

3.06 JOINT REINFORCEMENT, SINGLE WYTHE WALLS

- A. General: Provide continuous horizontal joint reinforcement for all single-wythe masonry walls, unless otherwise indicated. Lap reinforcing a minimum of 6 inches.
- B. Vertical Spacing: Not more than 16 inches on center.
- C. Continuity: Use prefabricated L-shaped and T-shaped sections at corners and

intersections. Do not span movement joints with reinforcement.

3.07 ANCHORING MASONRY

- A. Structural Framing Anchorage: Anchor masonry to structural framework at points of adjacency, and as follows:
 - 1. Maintain open space of 1 inch or more between face of framing member and masonry elements.
 - 2. Fasten anchors to structure and embed in mortar joints as masonry is laid.
 - 3. Space anchors at maximum of 36 inches on center horizontally and 24 inches on center vertically.

- B. Veneer Anchorage: Anchor masonry veneer to structural backup with anchors specified, and as follows:
 - 1. Fasten to backup with self-tapping, non-corrosive fasteners as recommended by manufacturer of anchors for substrate conditions.
 - 2. Space plates of two-piece anchors so they shall be centered on horizontal mortar joints, allowing maximum vertical movement of ties due to differential movement of veneer and backup.
 - 3. Embed tie sections of two-piece anchors in mortar as masonry is being laid, providing clear air space of at least 2 inches behind veneer wythe.
 - 4. Space anchors at not more than 1.77 square feet per anchor, not more than 16 inches on center horizontally and vertically. At openings and ends of veneer panels, provide additional anchors so that maximum spacing at perimeter is 8 inches on center.

3.08 INSTALLING REINFORCED UNIT MASONRY

- A. Preparation: Clean reinforcement bars of loose rust; do not use bars which have rusted excessively or which have bends or kinks not shown on drawings.

- B. Placing Reinforcement: Secure reinforcement accurately at locations indicated and to avoid displacement; minimum spacing between bars or to masonry surfaces must be bar diameter or 1/4 inch for fine grout and 1/2 inch for coarse grout, whichever is greater.

- C. Splicing: Provide lapped splices of minimum size indicated or permitted by governing code at locations shown; other methods or locations must be approved by the architect.

- D. Formwork: Construct formwork where required for temporary support of reinforced masonry, bracing as required to maintain proper shape during placement and curing of grout and adequately tight to avoid grout leakage.

3.09 INSTALLING CONCEALED STAINLESS STEEL MASONRY FLASHING

- A. General: Whether or not specifically indicated, install stainless steel flashing at all conditions such as lintels and shelf angles, where the downward flow of any water within the masonry shall be interrupted, so that such water shall be diverted to the exterior. Extend flashings full width at such obstructions and at least 4 inches into adjoining masonry, or turn up to form watertight pan at non-masonry construction. Remove or cover protrusions or sharp edges on to stainless steel flashing. Place flashings on sloped mortar bed; seal lapped ends and penetrations of flashing before covering with mortar.

- B. Stainless Steel Through-Wall Flashings: Bring completely through inner wythe and turn up where concealed by other construction; otherwise stop not more than 1/2 inch from inner face. Drop flashing at least 4 inches before bringing through outer wythe.

- C. Stainless Steel Veneer Flashings: Turn flashings up not less than 4 inches at backup. Lap top of flashing with building paper, or otherwise seal to prevent moisture penetration between flashing and backup.
- D. Heads and Sills: Turn up ends of flashing at least 2 inches at heads and sills to form a pan, and seal joints.
- E. Sealing: Seal all joints in flashing to assure watertight integrity.
 - 1. Lap end joints of flashings at least 4 inches; seal in accordance with manufacturer's instructions.
- F. Weep Hole Vents: Provide weep hole vents in head joints of the first course of masonry immediately above concealed flashings and in the top course of masonry. Space at intervals of 24 inches on center.
- G. Reglets and Other Accessories: Install to receive flashing where indicated.

3.10 REPAIRING MASONRY

- A. Replacement: Carefully remove areas of damaged masonry and replace with matching, undamaged units using mortar which matches original work.
- B. Remove and replace masonry units that are chipped, loose, broken, stained or otherwise damaged or if units do not match adjoining units.
- C. Pointing: As joints are being tooled, remove mortar with visible holes or mortar which cannot be compacted properly because of hidden voids, and replace with fresh mortar, filling each joint completely and tooling to match adjacent work.

3.11 CLEANING AND PROTECTION

- A. Clean masonry after mortar is thoroughly set and cured.
 - 1. Scrape off adhered mortar particles by hand, using non-metallic tools.
 - 2. Test cleaning methods on half of sample panel, leaving other half in original state.
- B. Protection: Institute protective measures as required ensuring that unit masonry work shall be clean and undamaged at substantial completion.

END OF SECTION 04 21 50

SECTION 05 10 30
STRUCTURAL STEEL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for structural steel used in the project including columns, beams, canopy and roof framing, framing for new stair opening, framing for elevator shaft, framing for escalator opening and support, etc. This work includes furnishing all labor, materials, accessories, tools and equipment required to furnish and install all structural steel including, but not limited to, fabrication, galvanizing, field erection, field preparation for painting and any other work required for a complete project.
- B. Unless noted otherwise, all new structural steel shall be galvanized. New structural steel exposed after installation shall also be coated with protective and finish coats in the field. Existing structural steel shall be field prepared and cleaned and also coated with protective and finish coats in the field.

1.03 STANDARDS

- A. The structural steel work required herein, except as otherwise shown, shall comply with the provisions of the following codes, specifications and standards:
- B. "Code of Standard Practice of Steel Buildings and Bridges", AISC.
- C. "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", AISC.
- D. "Structural Welding Code", AWS D1.1.
- E. "Specifications for Assembly of Structural Joints Using High Strength Steel Bolts" as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
- F. "Handbook on Bolt, Nut and Rivet Standards", Industrial Fasteners Institute.

1.04 QUALITY ASSURANCE

- A. The Contractor is solely responsible for quality control of all the structural steel work. The Contractor shall employ, at his own expense, a qualified independent testing laboratory to conduct specified Source Quality Control and Field Quality Control and provide reports to the Authority. Information regarding the testing agency shall be submitted to the Authority for approval prior to being hired by the Contractor.
- B. Contractor shall comply with all applicable governmental codes and regulations.
- C. Structural Welding Qualification: Weld Procedures and Welding Operators shall be qualified in accordance with ANSI/AWS D1.1, using the same type of equipment and welds to be used in the work.
1. Certify that each welder has satisfactorily passed AWS qualification tests for

welding processes involved and, if pertinent, has undergone recertification.

- D. Galvanize Coating Applicator's Qualifications: Company specializing in hot dip galvanizing after fabrication and following the procedures of "Quality Assurance Manual" of the American Galvanizers Association.

1.05 TESTING

- A. The testing agency to inspect all bolted connections and welds as well as perform all other required tests.
- B. The Contractor shall employ AISC Category III Fabricator's Testing Laboratory, in addition to the requirements of the Contractor's Quality Control Plan. Reports and test results shall be supplied for the inspections and tests listed in this specification.
- C. Bolted connections shall be inspected by the Testing Agency in accordance with AISC Specifications for "Structural Joints Using ASTM A 325 or A 490 Bolts".
- D. Welding will be inspected and tested by the Testing Agency during fabrication and erection of structural steel as follows:
 - 1. Certify all welders and make inspections and tests as required. Record types and locations of all defects found in the work, and measures required and performed to correct such defects.
 - 2. In addition to visual inspection of all welds, magnetic particle, ultra-sonic and radio-graphic inspection shall be made of all welds. Magnetic particle inspection shall be made on the root pass and finished weld.
 - 3. The method of magnetic particle inspection shall be in accordance with ASTM E-709. Any type of crack or zone of incomplete fusion or penetration will not be acceptable.
 - 4. Radio-graphic inspection technique and standards of acceptance shall be in accordance with AWS D1.1.
 - 5. Ultra-sonic inspection shall be performed in accordance with AWS D1.1.
- E. Each bolting crew and welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified that the inspector can refer back to the crew or person making the connection.
- F. Access to locations where material for this contract is being fabricated or produced shall be provided for the purpose of inspection and testing, including scaffolding.
- G. The Authority may inspect structural steel at the plant before shipment; however, the Authority reserves the right to reject any material, at any time before final acceptance, which does not conform to all of the requirements of the drawings and specifications.
- H. The Testing Agency shall perform the specified tests. Corrective measures, including additional and more complete testing, which may result from these tests shall be the Contractor's responsibility; all costs of which shall be paid for by the Contractor.
- I. Approved shop drawings are to be submitted to the galvanizer for his review and approval.

1.06 SUBMITTALS

- A. Shop Drawings: Submit to the Authority in accordance with the requirements of the Submittal Section of these specifications, the following:

1. Complete details and schedules for the fabrication of each member, and for shop assembly of members, including connections.
 2. Complete details, schedules, procedures and diagrams showing the sequence of erection.
 3. Complete shop drawings to indicate actual field-verified dimensions, elevations and details for all structural steel for this project. Shop drawings to be prepared and certified by a structural engineer licensed in the State of Illinois. Shop drawings to identify the size, location and erection details of all structural steel, connections, and all other details.
- B. Structural Calculations: Prior to fabrication of steel, furnish structural calculations with connection detail drawings for all structural steel and connections for the actual loading and conditions. Calculations shall be prepared by and sealed by the licensed structural engineer.
- C. Manufacturer's Literature: Submit to the Authority, copies of manufacturer's specifications and installation instructions for the products being supplied as well as for the welding, galvanizing, and any shop applied coats of paint; including laboratory test reports and such other data as may be required to show compliance with these specifications and specified standards.
- D. Surveys: If applicable, submit to the Authority, copies of certified survey(s) by the Contractor's registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and showing final elevations and locations for all major members.
- E. Mill Affidavits and Certifications: Prior to fabrication of Structural Steel, the Contractor shall submit to the Authority the following certified reports for the steel for the permanent structure:
1. Mill heat analysis of chemical composition.
 2. Tension, bend and notch toughness test reports.
 3. Mill certification that all supplementary requirements have been complied with.
 4. Certification that bolts meet all ASTM requirements for the grade specified.
- F. Submit weld procedures and qualifications for approval prior to fabrication.
- G. Provide certification from the galvanizer indicating that he has reviewed the approved shop drawings and certifies that he is capable of hot dip galvanizing all members and fabrications according to all requirements.
- H. Submit to the Engineer for approval all proposed galvanizing repair work, including materials and methods.

1.07 PRODUCT HANDLING

- A. Do not deliver material to the project site until the proposed method and sequence of erection has been reviewed by the Authority. Method and sequence shall be planned so as to avoid delay or damage to the work of other trades.
- B. Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Material stored at the job site shall not exceed design loads on existing or newly-constructed structures so that members will not be distorted or otherwise damaged; and shall be protected against corrosion or deterioration.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL

- A. Structural steel including beams, columns, angles, channels, plates, etc. shall comply with the provisions of the ASTM specifications for A 36 material unless noted otherwise on the Drawings.
- B. Structural steel tubes shall comply with ASTM A 500 Grade B.
- C. Provide and install all miscellaneous structural steel members required for this project including lintels, leveling, plates, base plates, setting plates, etc.

2.02 WELDING ELECTRODES

- A. Welding electrodes shall comply with the provisions of AWS specifications A 5.1, A 5.5, A 5.17, A 5.18, and A 5.20. Weld electrodes shall be E70XX unless required otherwise.

2.03 BOLTS

- A. All high strength bolts, nuts and washers shall comply with the provision of ASTM A 325.
- B. All anchor bolts, nuts and washers shall conform to the requirements of ASTM F 1554, GR 36.

2.04 GALVANIZING, SHOP PRIMING AND FINISHING

- A. All new structural steel members and fabrications to be hot dip galvanized, conforming to ASTM A123. Galvanized steel exposed to view after installation shall also be finished with protective and finish coats in the field. See painting section of these specifications.
- B. Existing structural steel members and fabrications will be prepared and field finished with protective and finish coats according to painting section of these specifications.
- C. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds and abraded areas in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint-20.
- D. Steel for Temporary Shoring need not be galvanized.

2.05 MISCELLANEOUS MATERIAL

- A. Miscellaneous material, accessories, grout, etc. not listed above shall be provided as specified hereinafter under the various items of work and/or as indicated on the drawings, or required for a complete structure according to specified standards.
- B. Provide supplemental structural steel support framing for metal deck where normal deck bearing is precluded by other framing members and around openings.

PART 3 EXECUTION

3.01 GENERAL

- A. Contractor must verify all dimensions and conditions in the field prior to fabricating and erecting structural steel. Notify the Authority of any major discrepancies.

- B. Field modification of structural steel is prohibited without prior written approval of the Engineer.

3.02 FABRICATION

- A. Material shall be properly marked and match-marked where field assembly is required. The sequence of shipments shall be such as to expedite erection and minimize the field handling of material.
- B. Fabricate and assemble structural steel in shop to greatest extent possible. Assemblies shall conform to the dimensions shown on the approved shop drawings.
- C. Beams shall be cambered where indicated on the Drawings.
- D. Beam connections shall be as shown or noted on the Drawings. Unless noted otherwise, standard connections shall be used.
- E. No combination of bolts and welds shall be used for stress transmission in the same face of any connection.
- F. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on shop drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning; ream holes that must be enlarged to admit bolts. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

3.03 WELDING

- A. Welding, filler metal, welding techniques and procedures shall be in accordance with AISC specification for the "Design, Fabrication and Erection of Structural Steel for Buildings", and AWS "Structural Welding Code" and "Filler Metal Specifications".
- B. Welding processes other than shielded metal arc and submerged arc may be used provided procedure qualification tests in accordance with the American Welding Society are made for the intended application of any such process.
- C. Built-up sections assembled by welding shall be free of warpage and all axes shall have true alignment.
- D. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
- E. All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints may be required.
- F. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
- G. Welded connections shall be detailed and designed to minimize the accumulation and concentration of thru-thickness strains due to weld shrinkage.

3.04 PREPARATION OF STEEL

- A. Perform all inspections prior to galvanizing or field finishing. For contact surfaces, roughen galvanized surfaces by means of hand wire brushing per ASTM A123. Power wire brushing is not permitted.
- B. All non-galvanized existing structural steel surfaces shall be prepared and cleaned as specified in the painting section of these specifications.
- C. Paint application shall be in accordance with paint manufacturer's printed instructions and recommendations. The fabricator shall submit paint system to be used for approval by the Authority prior to purchasing. All paint products shall be compatible products from the same manufacturer.

3.05 APPLICATION OF GALVANIZING

- A. Galvanize steel members, fabrications, and assemblies to the greatest extent possible after fabrication by the hot dip process in accordance with ASTM A 123 or A 153. All structural steel members shall have all pieces attached by welding to the greatest extent possible as shown on drawings before galvanizing. All bolted pieces shall be bolted together after galvanizing. Ream all holes as necessary prior to galvanizing.
- B. Prior to galvanizing, structural steel shall be cleaned of all mill scale, rust, spatter, slag or flux deposit, oil, dirt and other foreign material.
- C. Dip all structural steel members and metal fabrications assuring a sufficient coating of all surfaces, including corners, joints, holes, and other surfaces.
- D. Long steel members and large fabrications too large for a single dip in the galvanizing vat, shall be dipped in two applications to assure all surfaces are thoroughly and fully coated.
- E. Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with ASTM A 153. Oversize components, threads or otherwise allow for additional thickness of galvanizing.
- F. Safeguard products against steel embrittlement in conformance with ASTM A 143.
- G. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage or any distortion.

3.06 GALVANIZING COATING REQUIREMENTS

- A. Coating Weight: Conform with paragraph 5.1 of ASTM A 123, Table 1 of A 767, or Table 1 of ASTM A 153, as applicable.
- B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.07 TESTS FOR GALVANIZING

- A. Galvanizer shall inspect the entire galvanized surface to ensure compliance with ASTM requirements.
- B. Inspection and testing of hot dip galvanized coatings shall be done under the guidelines

provided in the AGA publication "Inspection of Products Hot Dip Galvanized After Fabrication".

- C. Include visual examination and tests in accordance with ASTM A 123, A 767 or A 153 as applicable to determine the thickness of the zinc coating on the metal surfaces.
- D. Furnish a certificate indicating compliance with ASTM Standards and Specifications herein listed. The certificate must be signed by the galvanizer and contain a detailed description of the material processed as well as information as to the ASTM standard used for the coating.

3.08 PAINTING

- A. See painting section of these specifications.
- B. Perform all inspections prior to finishing.
- C. Galvanized steel is to be prepared per ASTM D6386 for painting.
- D. Metal fabrications may have protective and finish coats installed in the shop if approved by the Authority. Do not provide finish coats to shop or field contact surfaces or within 2" of field welds. See painting section for description of protective and finish coats for steel.

3.09 BENCH MARKS

- A. The Contractor shall employ the services of a registered professional engineer who shall establish permanent bench marks, field check all elevations, of concrete on which structural steel is to be placed and locations of anchor bolts, reporting any discrepancies to the Authority before the work proceeds.

3.10 ERECTION

- A. The Contractor shall be responsible for the accurate setting and leveling of all bearing plates or setting plates. Bearing plates or setting plates shall be leveled on steel wedges or shims unless otherwise detailed.
- B. Furnish templates, where shown, specified or called for on the drawings. Furnish shim plates or developed fills where required to obtain proper fit and alignment.

3.11 ERECTION TOLERANCE

- A. The Contractor alone shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure. Any adjustments necessary in the steel frame because of discrepancies in elevations and alignment shall be the responsibility of the Contractor.
- B. Unless otherwise noted, individual members of the structure shall be leveled and plumbed to an accuracy of 1 to 500, but not to exceed 1/2" in columns for their full height, except exterior columns and columns adjacent to elevator beams shall be accurate to 1 to 1,000 but not to exceed 1/2" for their full height. All leveling and plumbing shall be done based on the mean operating temperature of the structure. Allowances shall be made for the difference in temperature at time of erection and the mean temperature at which the structure will be when completed and in service.

3.12 CONNECTIONS

- A. Connections between members and corners shall be mitered unless approved otherwise.

- B. No welding or bolting shall be done until as much of the structure as will be stiffened by the welding or bolting has been properly aligned.
- C. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged to admit bolts shall be reamed. Burning and drifting may be used to align unfair holes in secondary bracing members only, when acceptable to the Authority.
- D. When high strength bolts or high strength bearing bolts are used, the AISC specifications shall apply including values as noted therein, and installation by either "turn of nut tightening" or with torque wrenches. In using manual torque wrenches, the required torque can be read from the wrench dial. Care should be taken that the wrench is properly calibrated. Nuts shall be in motion when torque is measured. In using power wrenches, follow the recommendations of the wrench manufacturer.

3.13 FIELD ALTERATIONS

- A. Modifications required to structural steel fabrications to facilitate proper installation including cutting, drilling or welding shall be submitted to the Authority for written approval. Provide shop drawings of the proposed modifications certified by a licensed structural engineer.
- B. Repair and touch up galvanizing upon completion of alterations, bolting, welding, etc. of fabrications of existing steel as specified in the painting section.

3.14 SOURCE QUALITY CONTROL

- A. Connection Inspection: Perform 100% visual inspection of bolted and welded connections. Examine the surfaces, size, quality and placement of each connection to verify installation in accordance with Contract documents and approved shop drawings. Measure weld length and profile for 15% of welds, selected at random.
- B. Testing of High-Strength Bolted Connections: Test with calibrated torque wrench on at least 25% of the bolts in each bolted connection, but not less than 2 bolts.
- C. Magnetic Particle Testing of Welds: Test in accordance with ASTM E 709 and include not less than the following items:
 - 1. 20% of continuity plate, end plate, and bracing gusset plate fillet welds, selected at random, final pass only.
 - 2. 100% of tension member fillet welds, e. g. hanger rod connections and other similar connections, root and final passes.
 - 3. 100% of partial penetration welds, e.g. built-up members and other similar members, root and final passes.
 - 4. 100% of built-up member fillet welds in zones of moment connections, root and final passes.
 - 5. 20% of other built-up member fillet welds, selected at random, final pass only.
 - 6. 10% of other miscellaneous fillet welds, selected at random, final pass only.

3.15 FIELD CLEANING AND PAINTING

- A. Field cleaning and painting shall conform to the requirements of the painting section of these specifications, including preparation of existing surfaces, preparation of galvanized surfaces, touch-up of galvanizing and application of prime and finish coats at field welds, bolted connections, abraded areas and other areas of the exposed steel.

END OF SECTION 05 10 30

SECTION 05 31 00
STEEL DECK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Furnish and install all metal deck for roof and related items as shown on the drawings and specified herein.

1.03 RELATED WORK

- A. Division 05 Section, Structural Steel.
- B. Division 07 Sections, Roofing Systems.

1.04 REFERENCES

- A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.
- B. AISI SG-671 -Specification & Commentary for the Design of Cold-Formed Steel Structural Members.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical Quality).
- D. ASTM A666 -Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM A611 - Standard Specification for Steel, Cold-Rolled Sheet, Carbon, Structural.
- G. AWS D1.1 - Structural Welding Code – Steel.
- H. AWS D1.3 -Structural Welding Code - Sheet Steel.
- I. SDI-27 - Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution.
- J. SSPC SP-6 - Commercial Blast Cleaning.
- K. SSPC Paint-20 – Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).

1.05 SUBMITTALS

- A. Submit manufacturer's certifications, as required, to show compliance with these specifications.
- B. Provide certification that each welder has been qualified in accordance with AWS D1.1 an AWS D1.3 within the previous 12 months.

- C. Submit manufacturer's specifications including; shop painting when shop painted units are to be used, installation instructions for each product specified, quantity and marking of deck units, size and location of holes to be cut and erection procedures including schedules, procedures, and diagrams showing sequence of erection.
- D. Submit detailed shop drawings showing large scale cross sectional details of the decking, connections, layout of deck units, placement directions, bearing on structural supports, anchorage details, attachment of accessories, and every condition requiring closure panels, supplementary framing, special jointing, and other accessories. Details and layout shall show location of supporting members, quantity and marking of decking units, size and location of holes to be cut, and the location, type, and sequence of welded connections. Shop drawings shall show the structural properties of the decking units.

1.06 QUALITY ASSURANCE

- A. The latest editions of AISI SG-671, AWS D1.1, AWS D1.3 and SDI-27 form a part of this specification to the extent indicated by the references thereto.
- B. Use qualified welding processes and operators in accordance with "Welder Qualification" AWS procedures.
 - 1. Qualification for Field Welding: Qualify the welding operators and welding procedures for welding of shear studs, steel deck and deck accessories to structural supports in accordance with AWS D 1.1 and D 1.3 requirements, using the same type of equipment and welds to be used in the Work. Perform qualifications prior to start of the Work, and on a periodic basis during the Work as deemed necessary by the Engineer.
- C. Provide metal deck units, which have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire rated construction.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site at such intervals as will avoid delay to the work.
- B. Handle material safely and in a manner that will prevent distortion or other damage.
- C. Store materials in a clean, properly drained location. Keep material off the ground under a weather-tight covering permitting good air circulation.
- D. Finish of decking units shall be maintained at all times using touch-up paint whenever necessary to prevent the formation of rust. Touch-up paint for zinc coated units shall be a high zinc content, galvanizing repair paint.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Roof Deck Units:
1. Consolidated Systems, Inc.
 2. Epic Metals Corp.
 3. United Steel Deck, Inc.
 4. VersaDeck Industries.
 5. Vulcraft/Div. Nucor Corp.
 6. Wheeling Corrugating Co.
 7. Or approved equal.

2.02 MATERIALS, GENERAL

- A. Unless otherwise indicated, all metal deck shall be galvanized steel sheet conforming to ASTM A653, Grade to comply with SDI specifications. Decking shall be shop prime painted over galvanized metal after fabrication.
- B. Flexible rubber closure strips shall be manufacturer's standard made of vulcanized, closed-cell, synthetic rubber.
- C. Galvanizing shall conform to ASTM A924, G60 (0.60 ounce per square foot).
- D. Galvanizing repair paint shall conform to SSPC Paint 20.
- E. No. 10 Tek screws, self-tapping, galvanized.

2.03 FABRICATION

- A. Deck units shall be in lengths to span three or more supports with flush, telescoped, or nested 2 inch end laps and nesting side laps, unless otherwise indicated. Deck configurations shall comply with SDI specification and as specified herein.
- B. Fabricate metal closure strips of not less than 18 gauge galvanized sheet steel of the same quality as the deck units. Form to the configuration required to provide tight fitting closures at open ends and sides of decking.
- C. Metal decking shall be of the type shown and shall have the depth, gauge, and structural properties as indicated on the drawings. Unless shown otherwise or otherwise required for actual loads and spans; use Wide Rib Decking, 18 gauge, 1 1/2 inch deep.

PART 3 EXECUTION

3.01 FIELD INSTALLATION

- A. Install deck units and accessories in accordance with the manufacturer's and SDI's recommendations, final shop drawings and as specified herein.
- B. Locate decking bundles to prevent overloading of structural members.
- C. Place deck units on supporting steel framework with edges up and flutes at right angles to supports. Adjust to final position with ends bearing on supporting members not less than 3 inches and accurately aligned end to end before permanently fastening. Triple span or more when possible. Lap ends not less than 2 inches for welded construction on

all decks. Side laps shall be one half corrugation. Do not stretch or contract the side lap interlocks. Place deck units flat and square, secured to adjacent framing without warp or excessive deflections, and with close alignment between cells at ends of abutting deck units.

- D. Permanently fasten roof deck units to steel supporting members with fusion welds not less than 3/4 inch diameter or with elongated welds of equal length, not more than 12 inches on center at supports, and at closer spacing where recommended by deck manufacturer. Deck shall function as a rigid diaphragm. Comply with AWS requirements and procedures for manual shielded metal-arc welding, the appearance and quality of welds, and the methods used in correcting welding work.
- E. Fasteners: Lock side laps between adjacent deck units at intervals not exceeding 36 inches on center by button punching or mechanical fasteners. End laps and end terminating at supports shall be fastened at each side lap plus an intermediate fastener.
- F. Cut and fit deck units and accessories around other work projecting through or adjacent to the decking, as shown on the drawings. Provide neat, square, trim cuts.
- G. Provide metal closure strips at all open uncovered ends and edges of roof decking, and in the voids between decking and other construction. Weld into position to provide a complete decking installation.
- H. Hanger slots or clips are not permitted.
- I. Provide additional metal reinforcement and closure pieces as shown on the Drawings or as specified elsewhere or as required for strength, continuity of decking, and support of other work. Reinforce roof decking around openings less than 12 inches in any dimension by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide steel sheet of the same quality as the deck units, not less than 18 gauge, and at least 12 inches wider and longer than the opening. Provide welds at each corner and spaced not more than every 12 inches along each side. Openings larger than 12 inches shall be reinforced by a steel subframing supported from main structural members, as shown on the drawings.

3.02 TOUCH-UP PAINT

- A. After decking installation, wire brush clean, and touch-up cut, scarred areas, welds, and rust spots on surfaces of decking units. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with the manufacturer's instructions.

3.03 QUALITY CONTROL

- A. Visual Inspection of Field Connections: Perform 100 percent visual inspection of the steel deck installation, including deck accessories and shear studs. Examine the surfaces, size, quality and placement of connections to verify installation in accordance with Contract Documents and shop drawings.

- B. Testing of Shear Connectors: Conduct standard in-place shear stud bend test of 5 percent of the studs, and a minimum of 2 connectors per beam, in accordance with AWS D 1.1 requirements.

END OF SECTION 05 31 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section includes but is not limited to the following metal fabrications:

1. Bearing plates.
2. Elevator entrance sill angles.
3. Miscellaneous framing and supports for elevator hoistway entrances, and applications where framing and supports are not specified in other sections.
4. Miscellaneous steel trim.
5. Rough hardware.
6. Steel plate closure covers, frames and panels.
7. Cane Rails
8. Ladders.
9. Downspouts.
10. Conduit beam cover.
11. Aluminum columns, framing and deck
12. Galvanized bar grating

- B. Fabrications have additional requirements that are listed in Section 05 10 30. These fabrications include, but are not limited to:

1. Framing for new Elevator Shaft.
2. Framing for new Stair Opening.

1.03 RELATED WORK

- A. Section 05 10 30, Structural Steel
- B. Section 05 70 00, Metal Panels
- C. Section 07 60 00, Flashing and Sheet Metal
- D. Section 08 71 00, Door Hardware
- E. Section 08 80 00, Glass Glazing
- F. Section 09 90 00, Painting
- G. Section 10 45 40, Rotogates

1.04 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this section.

1.05 REFERENCES

- A. Illinois Department of Transportation (IDOT): "Standard Specifications for Road and Bridge Construction".
- B. American Galvanizers Association(AGA) - Recommended Details For Galvanized Structures.
1. Inspection of Products Hot Dip Galvanized After Fabrication
 2. The Design of Products to be hot Dip Galvanized After Fabricaiton
 3. Recommenced Details of Galvanized Structures.
- C. ANSI A14.3 – Safety Requirements for Fixed Ladders.
- D. ANSI B18.2.1 - Square and Hex Bolts and Screws - Inch Series
- E. ANSI B18.6.3 - Machine Screws and Machine Screw Nuts.
- F. ANSI B18.22.1 - Plain Washers.
- G. ANSI B18.21.1 – Lock Washers (Inch Series).
- H. ANSI/NAAMM - MBG 532, Heavy Duty Metal Bar Grating Manual
- I. ASTM A27/A27M – Standard Specification for Steel Castings, Carbon, for General Application.
- J. ASTM A36/A36M - Specification for Carbon Structural Steel.
- K. ASTM A47 – Standard Specification for Ferritic Malleable Iron Castings.
- L. ASTM A48 – Standard Specification for Gray Iron Castings.
- M. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- N. ASTM A143 - Safeguarding Against Embrittlement Of Hot Dipped Galvanized Structural Steel Products And Procedures For Detecting Embrittlement.
- O. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- P. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium- Nickel Steel Plate, Sheet, and Strip.
- Q. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
- R. ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
- S. ASTM A384 - Safeguard Against Warpage And Distortion During Hot-Dipped Galvanizing Of Steel Articles.

- T. ASTM A385 - Providing High Quality Zinc Coatings (Hot Dip).
- U. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- V. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- W. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
- X. ASTM A554 – Standard Specification for Welded Stainless Steel Mechanical Tubing.
- Y. ASTM A563/A563M – Standard Specification for Carbon and Alloy Steel Nuts.
- Z. ASTM A653/A653M-03 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- AA. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- BB. ASTM A743/A743M – Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
- CC. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- DD. ASTM A786/A786M – Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
- EE. ASTM A793 – Standard Specification for Rolled Floor Plate, Stainless Steel.
- FF. ASTM A1008/A1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- GG. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- HH. ASTM B221/B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- II. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- JJ. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
- KK. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- LL. ASTM F738M - Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs.
- MM. ASTM F594 – Standard Specification for Stainless Steel Nuts.
- NN. ASTM F836M - Standard Specification for Style 1 Stainless Steel Metric Nuts.

- OO. AWS D1.1 - Structural Welding Code—Steel.
- PP. AWS D1.3 - Structural Welding Code--Sheet Steel.
- QQ. FS FF-325 - Shield, Expansion; Nail, Expansion; and Nail, Drive Screw.
- RR. FS FF-B-575C - Bolts, Hexagon and Square.
- SS. FS FF-B-588 – Bolt, Toggle: And Expansion Sleeve, Screw.
- TT. NAAMM - Metal Finishes Manual.
- UU. NAAMM - Metal Stair Manual.
- VV. NAAMM - Recommended Voluntary Minimum Standards for Fixed Metal Stairs.
- WW. SSPC-PA 1 - SEE SSPC 96-02 - Shop, Field, and Maintenance Painting - Included in a set (96-02) with PA 1, 2, 3, 4, 5 and QP1 and QP2I.
- XX. SSPC-SP6 - Commercial Blast Cleaning.

1.06 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install the following metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.
 - 1. Top Rail of Guardrail Systems & Leaning Bars: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 300 lb applied at any point nonconcurrently, vertically downward, or horizontally.
 - b. Uniform load of 50 lb per linear ft. applied vertically downward concurrent with a uniform load of 75 lb per linear foot applied horizontally.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lb applied at any point non-concurrently, vertically downward or horizontally.
 - b. Uniform load of 50 lb per linear foot applied vertically downward concurrent with a uniform load of 75 lb per linear foot applied horizontally.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lb applied to one sq. ft. at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area. Load need not be assumed to act concurrently with uniform horizontal loads on top rails of railing systems in determining stress on guard.
 - 4. Steel Stairs:

- a. Treads: Capable of withstanding a uniform load of 100 lb per sq. ft. or a concentrated load of 300 lb on a area of 4 square inches located in the center of the tread, whichever produces the greater stress.
 - b. Platforms: Capable of withstanding a uniform load of 100 lb per sq. ft.
 - c. Limit deflection of treads, platforms, and framing members to $L/360$ or 0.02 in, whichever is less, for a concentrated load of 500 lb applied anywhere on the structure.
5. Heavy-Duty Metal Bar Gratings: Capable of withstanding a uniform load of 250 pounds per square foot. Deflection with design live loading shall not exceed $1/240$ of the span.
 6. Windbreaks, Stair Enclosures: Capable of withstanding sustained wind gusts up to 100 mph for 60 seconds without detaching from curbing, platform, steel structures, and other construction to which anchorage occurs. Provide brackets, anchors and framing, at platform to support windbreaks with deflection limited to $L/360$.
 7. Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. For items, components or assemblies to receive Hot Dip Galvanized Finish, Fabricator shall comply with detailing recommendations contained the AGA publication, "The Design of Products to be Hot Dip Galvanized After Fabrication". Detailing shall eliminate the need for field welding of hot dip galvanized fabrications.
- C. For galvanized coating applications to surfaces exposed to view, submit notarized Certificate of Compliance with ASTM Standards and Specifications listed herein, signed by galvanize applicator. In certificate, give detail description of material processed, include information as to the ASTM Standards used for coating, and include visual examination and test results.

1.07 SUBMITTALS

- A. Product data for products used in miscellaneous metal fabrications, including finishes, paint products and grout.
- B. Shop drawings showing sizes and detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, profiles, and details of metal fabrications and their connections. Indicate heights, sizes and spacings of components. Show anchorage, joinery and accessory items. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation. Where applicable, indicate field verified dimensions on shop drawings.
1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed.
 2. Indicate field verified dimensions on shop drawings.
 3. Indicate on shop drawings location of gates and all details and dimensions. Provide cuts for all gate hardware.
- C. Furnish engineering calculations for stairs, railings, barriers, and other metal fabrications where performance requirements are given as prepared by a structural engineer licensed in the State of Illinois and as required by IDOT, showing that maximum stresses and deflections do not exceed specified performance requirements under full design loading. Calculations shall be prepared and sealed by a structural engineer licensed in the State of Illinois.

- D. Samples representative of materials and finished products as may be requested by IDOT, in specified finish.
- E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, and other information specified.
- G. Provide samples of specified finishes, including paint type coatings shop applied.
- H. Fabricator of items, components or assemblies listed in Section 05030 – Hot Dip Galvanizing shall provide letter certifying compliance with fabrication requirements of the section.

1.08 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
- C. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project.
- D. Regulatory Requirements: Comply with applicable requirements of all governing codes, ordinances and regulations. Fabricate and install handrails in accordance with the Americans with Disabilities Act (ADA) Guidelines.
- E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel", or when applicable, comparable AWS D1.6 standards for stainless steel.
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- F. Pre-Installation Conference: Conduct conference at Project site.
- G. Galvanize Coating Applicators Qualifications Company specializing in hot dip galvanizing after fabrication and following the procedures of 'Quality Assurance Manual' of the American Galvanizers Association.
- H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups for the following types of decorative metal:
 - a. Railings and Guardrails: Two full size adjacent modules for platform and stair railings and guardrails.
 - b. Conduit Beam Covers: Two full size adjacent panels including one end

- cover.
- c. Roofing over Exit Stair: One 8'-0" length of roofing showing edge conditions.

2. Build at locations and to designs directed by the architect.
3. Do not begin mock-up construction until the Authority is present.
4. Adjust until mock-up appearance and workmanship are acceptable to the Commissioner.
5. Upon completion of construction and at the direction of the Commissioner, completed and approved mock-ups may remain as part of the Work.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications shall fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Verify all conditions for installation of the work.
- B. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for adjustments, trimming and fitting.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.
- B. Mount handrails only on completed walls or other construction. Do not support handrails temporarily by any means not satisfying structural performance requirements.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Store fabricated components and materials in clean, dry locations, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation within covering.
- B. Handle metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

PART 2 PRODUCTS

2.01 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 20 percent.
- B. Metal Surfaces, General:
1. For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, stains, discolorations,

- and, for steel sheet, "oil canning" and variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
2. Provide materials for galvanizing that are geometrically suitable for galvanizing as described in ASTM A384 and A385.
- C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Steel Tubing: Product type (manufacturing method) and as follows:
1. Cold-Formed Steel Tubing: ASTM A500, Grade A, unless otherwise indicated or required for design loading.
 - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A53.
 - b. For exposed galvanized installations and where indicated, provide materials with hot dip galvanized coating complying with ASTM A385.
- E. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:
1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M.
 2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M.
- F. Galvanized Steel Sheet: Quality as follows:
1. Commercial Quality: ASTM A653/A653M, G90 coating designation unless otherwise indicated.
- G. Steel Pipe: ASTM A53; finish, type, and weight class as follows:
1. Provide galvanized finish for exterior installations and where indicated.
- H. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- I. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27/A27M. Provide bolts, washers, shims as required, hot-dip galvanized per ASTM A153.
- J. Elastomeric Pads: Comply with Section 783 of the Standard Specifications.
- K. Gray-Iron Castings: ASTM A48, Class 30.
- L. Malleable-Iron Castings: ASTM A47, Grade 32510 (ASTM A47M, Grade 22010).
- M. Rolled Steel Floor Plate: ASTM A786/A786/M.
- N. Steel Bars for Gratings: ASTM A1011/A1011M or ASTM A36/A36M.
- O. Slotted Channel Framing: Cold-formed metal channels with continuous slots complying with MFMA-3.
1. Size channel as indicated.
 2. Fore Engineered Slotted Channel Framing: Provide size and number as determined by structural analysis.

A. Stainless Steel: Provide stainless steel, Type 304, in form indicated complying with the following requirements:

1. Tubing: ASTM A554.
2. Pipe: ASTM A312/A312M.
3. Plate and Sheet: ASTM A167.
4. Sheet, Strip, Plate, and Flat Bars: ASTM A666.
5. Bars and Shapes: ASTM A276.
6. Rolled Floor Plate: ASTM A793.
7. Bar Stock: ASTM A276.
8. Castings: ASTM A743/A743M.

2.03 ALUMINUM

A. Aluminum canopy columns, framing members and metal deck to match existing as indicated on the drawings.

2.04 FASTENERS

A. General: Stainless steel fasteners shall be used for all locations. Do not use metals that are corrosive or otherwise incompatible with metals joined. Select fasteners for the type, grade, and class required and for type of loading and installation condition shown or as specified by the manufacturer.

1. Provide concealed fasteners for interconnection of decorative metalwork components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

B. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A (ASTM F568M, Property Class 4.6), with hex nuts, ASTM A563/A563M, ASTM F593 stainless-steel bolts with ASTM F594 Nuts and, where indicated, flat washers.

C. Lag Bolts: ANSI B18.2.1.

D. Machine Screws: ANSI B18.6.3.

E. Plain Washers: Round, carbon steel, ANSI B18.22.1.

F. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assemblies of type as required for installation condition shown; and of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

1. Material: Stainless-steel bolts and nuts complying with ASTM F593/F738M and ASTM F594/F836M.

H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

I. Primer Paint: As specified in Section 09960, High-Performance Coatings.

2.05 WELDING

- A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded. Provide type and alloy of filler metal and electrodes as specified by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.

2.06 GROUT

- A. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically specified by manufacturer for interior and exterior applications. For galvanized surfaces exposed to view, comply with ASTM A385.
- B. Products:
 - 1. Non-Shrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W. R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.
 - f. Five Star Grout; Five Star Products.
 - g. Vibropruf #11; Lambert Corp.
 - h. Crystex; L&M Construction Chemicals, Inc.
 - i. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - j. Sealtight 588 Grout; W. R. Meadows, Inc.
 - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
 - l. Kemset; The Spray-Cure Company.

2.07 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles, curves and surfaces and straight sharp edges. Form to required shapes and sizes. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.
- C. Allow for thermal movement resulting from 100 degrees Fahrenheit maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed surfaces.
- G. Weld corners and seams continuously to comply with AWS specifications and the

following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent. Grind exposed welds flush and smooth to match and blend with adjoining surfaces.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous. Cope or miter corner joints.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- J. Provide necessary lugs and brackets for assembly of units. Use concealed fasteners wherever possible.
- K. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- L. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- M. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.08 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish stainless steel washers for heads and nuts.

2.09 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated and required. Comply with requirements of ANSI A14.3 and OSHA.
- B. Siderails: Continuous steel flat bars, 1/2 inch by 3 inches, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: Round steel bars 1-inch diameter spaced 12 inch on center.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 5 foot-0 inch on center by means of welded or bolted steel brackets. Secure firmly and

securely to solid structure.

1. Size brackets and anchorage to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 6 inches.
 2. Extend side rails 42 inches above top rung where possible, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.
- F. Hot dip galvanize ladder assembly after fabrication, then apply primer and top coats in shop in accordance with Section 099000, Painting.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.
- B. Hot dip galvanize bearing and leveling plates.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Provide steel framing and supports for applications indicated or which are not parts of structural steel framework, as required to complete work.
- B. Provide shop drawings showing applicable field verified sizes, details. Coordinate with supplier of equipment or product framing is supporting, if applicable.
- C. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Except as otherwise indicated, space anchors 24 inches on center and provide minimum of 2 anchors per unit when unit is 24 inches or less. Secure miscellaneous framing securely to structure by welding or anchoring as approved. Install to withstand all applicable loadings and stresses.
- D. Galvanize miscellaneous framing and supports after fabrication, touch up galvanizing in field, and also prime and paint any exposed surfaces. Refer to Section 09960, High-Performance Coatings, for painting requirements.

2.12 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work. Anchorages to be concealed unless approved otherwise.
- B. Galvanize miscellaneous steel trim, framing and supports after fabrication. Also prime and provide top coats for any exposed steel trim. Refer to Section 09960, High-Performance Coatings, for painting requirements.

2.13 ELEVATOR SILL ANGLE

- A. Size, length and location as indicated on elevator shop drawings and as otherwise required. Anchor to structure, set into concrete and masonry. Angle to be hot dip galvanized.

2.14 STEEL PLATE CLOSURES, COVERS, FRAMES AND PANELS

- A. Provide the required sizes, shapes and profiles. Except as otherwise shown, fabricate from structural steel plate of all welded construction using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the work. Neatly dress risers arrises, edges, corners and welds so as to be flush, straight, and square for best appearance.
- B. Flatness Tolerance: Deviations for faces of flat panels shall not exceed 1/16 inch in 4 foot-0 inch at any location, and 1/8 inch total for the entire face.
- C. Provide all fasteners, mounting plates, angles and framing necessary to securely fasten fabricated panels to structure at finished as hot dip galvanized.
- D. Hot dip galvanize ferrous metal fabrications. Also provide primer and top coats for

exposed steel. Refer to Section 09900, Painting, for painting requirements.

2.15 DOWNSPOUTS

- A. Fabricate and install galvanized steel downspouts as shown on the drawings and approved shop drawings. See drawings for locations, design, sizes and details for Downspouts.
- B. All connections and fasteners shall be stainless steel.
- C. Refer to Section 07600, Flashing and Sheet Metal for gutters. Refer to Division 16 Sections for heat tracing of related horizontal drains.

2.16 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes for all metals.
- B. Finish metal fabrications after assembly.
- C. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.
- D. Exposed Galvanized Steel: Where exposures of galvanized steel to public view occur and where indicated, conform to ASTM A384 and A385.
 - 1. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
 - 2. Consult with Engineer and galvanizer regarding potential problems during galvanizing that might require modification of design. Consult Engineer before fabrication proceeds.
 - 3. Remove all welding slag, splatter, anti-splatter compounds, and burrs before delivery to galvanizer.
 - 4. Provide holes and / or lifting lugs to facilitate handling during the galvanizing.
 - 5. Avoid unsuitable marking paints. Remove grease, oil paint, and other deleterious materials before fabrication.
 - 6. Remove by blast cleaning or other approved methods, surface contaminants, and coatings that are not removable by normal chemical cleaning process in the galvanizing process.
 - 7. Whenever possible, use slip joints to minimize field welding.
 - 8. Coating Weight: Provide coating weight s per table 1, ASTM A126 with minimum coating thickness on any galvanized item of 460g/m² (Grade 65). Conform to paragraph 5.2 of ASTM A123, Table q of ASTM A767, or Table 1 of ASTM A153, as appropriate. Refer to ASTM A123 3.1.7 for special thickness requirements and provide minimum average mils of thickness.
 - 9. Provide surfaces finish that is continuous, adherent, smooth and evenly distributed, and free from any defect detrimental to stated use of coated article.
 - 10. Provide adhesion to withstand normal handling.
 - 11. Test and inspect coated article following guidelines stated in AGA's "Inspection of Products Hot Dip Galvanized after Fabrication."
- E. Exposed Galvalume: For metal surfaces indicated as having a Galvalume finish, including, but not limited to conduit beam covers and roofing over exit stairs, conform to ASTM Specification A792 "Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process." Minimum coating weight: AZ55.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: When indicated as galvanized on the Drawings, galvanize items fabricated from ferrous metal. Apply zinc-coating by the hot-dip process after fabrication of assemblies. Galvanize in compliance with the following requirements:
 - 1. ASTM A153 for galvanizing iron and steel hardware.
 - 2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Preparation for Galvanizing: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. SSPC Zone 1B: SSPC-SP6.
- C. Where steel is to also be finished with primer and top coats, apply shop primer to galvanized surfaces of metal fabrications, except portions to be embedded in concrete or masonry. Comply with requirements of SSPC-PA1. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

2.18 STAINLESS STEEL FINISHES

- A. Finish designations prefixed by AISI conform with the system established by the American Iron and Steel Institute for designating finishes for stainless steel sheet.
- B. Satin Finish: AISI No.4 polished, 180 grit, non-directional texture to match approved sample. Direction of texture shall be parallel to the long dimension of the member or surface.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.
- C. Field verify all dimensions and conditions for the installation of all metal fabrications. Coordinate with approved shop drawings.

3.02 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required. Secure to meet all design loading and stresses.
1. Except where otherwise shown or specified, fasten metal fabrications to solid concrete or masonry with expansion bolts.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete, masonry or similar construction.
- C. Fit exposed connections accurately together to form hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of metal items, restore finishes to eliminate any evidence of such corrective work.
- D. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units, which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.
- E. Field Welding: Comply with applicable AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld connections, which cannot be shop welded because of shipping size limitations.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- F. Do not cut or abrade finishes, which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.
1. Paint the contact surfaces of dissimilar materials and metal other than aluminum in contact with masonry or concrete work, with a heavy coating of epoxy paint.

3.03 SETTING LOOSE PLATES

- A. Clean concrete bearing surfaces of any bond-reducing materials, and roughen to improve

bond to surfaces. Clean bottom surface of bearing plates.

- B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
1. Use nonmetallic non-shrink grout unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLATION OF RAILINGS, HANDRAILS, BARRIERS, HIGH BARRIERS AND GATES

- A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
1. Anchor posts in concrete by core drilling holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's directions.
 2. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
 3. Anchor rail ends into concrete with steel flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
 4. Anchor rail ends to steel with steel flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.
- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Use type of bracket with pre-drilled hole for exposed bolt anchorage.
 3. For concrete anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
- C. Align rails so that variations from level for horizontal members and from parallel with rake of steps for sloping members do not exceed 1/4 inch in 12 feet. Align at abutting joints.
- D. Welded Connections: Use fully welded joints; cope or butt components to provide full contact. At exposed welded connections, finish exposed welds and surfaces smooth and blended so that no roughness is evident (by sight or touch) after finishing, and welded surface matches contours of adjoining surfaces.
- E. Expansion Joints: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.
- F. Install railings, cane rail, barriers and gates as shown on drawings. Install all hardware for gate, provide all required accessories, and make all necessary adjustments.

- G. Installation to be rigid, straight, level, and secure. Installation to meet all applicable codes. Touch up any paint finish after installation.

3.05 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing steel stairs to in place construction. Include threaded fasteners for concrete inserts, through-bolts, lag bolts, and other connectors as required; weld stair framing to steel structure.
- B. Set steel stair base plates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge or bearing plate.
- C. If stair is to be set into concrete, pack voids solid with nonmetallic, nonshrink grout after installation.
- D. Install stair units accurately in location, alignment, and elevation with edges and surfaces level, plumb, true, and free of rack.
- E. Center nosings on tread widths with nosings flush with tread surfaces.

3.06 INSTALLING GRATINGS

- A. Install gratings to comply with recommendations of NAAMM grating standard referenced that apply to grating types and sizes indicated, including installation clearances and standard anchoring details. Verify size of openings and conditions in the field. Set gratings at proper elevations, flush with adjacent surfaces.
- B. Review elevator shop drawings for size, type and details for grating at penthouse and/or at sump pit.

3.07 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces of fabrications other than those listed in Section 05030, clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- C. Clean stainless steel with soap and water; rinse with clear water.

3.08 FINISHES

- A. Unless fabricated of prefinished material or stainless steel, all metal fabrications to be hot dip galvanized in the factory after fabrication per referenced standards.
- B. For fabrications, other than those listed in Section 05030, exposed to view, finish galvanized fabrications in the shop, if possible, by cleaning galvanized surfaces, priming and application of finish coats. Follow paint manufacturer's recommendations. See Painting Section of these specifications for painting system. Touch up any welded or otherwise damaged galvanized surfaces with galvanizing repair paint prior to prime and finish coats.

- C. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
- D. Where exposure to view and no painting occurs on galvanized surface, repair damaged areas by one of the methods described in ASTM A780 whenever damage exceeds 3/16-inch in width. Provide minimum thickness of repair as described in ASTM A123 Section 4.6.

3.09 PROTECTION

- A. Protect finishes of metalwork from damage during construction period by use of temporary protective coverings approved by fabricators. Remove protective covering at time of substantial completion.
- B. For pre-finished surfaces or stainless steel, restore protective coverings, which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
- C. Restore finishes damaged during installation and construction period so that no evidence remains of corrective work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION 05 50 00

SECTION 05 50 40
METAL STAIRS WITH CAST ABRASIVE TREADS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section includes, but is not limited to all metal fabrications not specified elsewhere:
1. Metal stairs, landings, platforms.
 2. Cast abrasive treads.
 3. Handrails, railings, platform railings.
 4. Galvanized metal bar gratings.
- B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 5 Section "Structural Steel" for structural steel framing system components.
 2. Division 9 "Painting".

1.03 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this section.

1.04 SYSTEM REQUIREMENTS

- A. Fabricate and install the following metal fabrications as designed and detailed on the structural drawings:
1. Top Rail of Guardrail Systems and Leaning Bars.
 2. Handrails Not Serving as Top Rails.
 3. Infill Area of Guardrail Systems. Includes panels, intermediate rails, balusters or other elements composing the infill area.
 4. Steel Stairs, including treads, tread supports platforms, platform support and stringers: Treads: Capable of withstanding a uniform load of 100 lb per sq. ft. or a concentrated load of 300 lb on a area of 4 sq. inches located in the center of the tread, whichever produces the greater stress. Platforms: Capable of withstanding a uniform load of 100 lb per sq. ft. Limit deflection of treads, platforms, and framing members to L/360 or 1/4" whichever is less.
 5. Galvanized Metal Bar Gratings.
- B. In general, for steel, connections are to be made with shop welds and field bolting.
- C. Galvanization:
1. For items, components or assemblies to receive Hot Dip Galvanized Finish, Fabricator shall comply with detailing recommendations contained the AGA publication, "The Design of Products to be Hot Dip Galvanized After Fabrication". Detailing shall eliminate the need for field welding of hot dip galvanized fabrications.
 2. For galvanized coating applications to surfaces exposed to view, submit

notarized Certificate of Compliance with ASTM Standards and Specifications listed herein, signed by galvanize applicator. In certificate, give detail description of material processed, include information as to the ASTM Standards used for coating, and include visual examination and test results.

1.05 SUBMITTALS

- A. General: Submit each item in this Article.
- B. Product data for products used in miscellaneous metal fabrications, including finishes, paint products and grout.
- C. Shop drawings showing sizes and detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, profiles, and details of metal fabrications and their connections. Indicate heights, sizes and spacings of components. Show anchorage, joinery and accessory items. Where applicable, indicate field verified dimensions on shop drawings.
 - 1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed.
 - 2. Indicate field verified dimensions on shop drawings.
- D. Sample of typical cast abrasive stair tread, 12" long. Samples representative of other materials and finished products as may be requested by Authority; in specified finish.
- E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, and other information specified.
- G. Provide specifications for galvanizing, primer, and top coat finishes. Provide samples of specified finishes. Provide color charts. Indicate compatibility of painting system and recommendations for application of galvanizing, primer and top coats.
- H. For galvanized coating applications, submit notarized Certificate of Compliance with ASTM Standards and Specifications listed, signed by galvanizing applicator.
- J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for stairs and railings.
- L. Test railings according to ASTM E894 and ASTM E935.
- K. Provide product data for cast abrasive stairs treads including surface design (lines or diamond cross hatching), spacing of lines or crosshatch, type of slip resistant granules, color, etc.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
- C. Regulatory Requirements: Comply with applicable requirements of all governing codes, ordinances and regulations. Fabricate and install handrails in accordance with the ADA Guidelines.
- D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual", for class of stair designated, unless more stringent requirements are indicated.
- E. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" and D1.3 "Structural Welding Code - Sheet Steel"; or when applicable, comparable AWS standards for 304 stainless steel.
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings".
- G. Galvanize Coating Applicator's Qualifications: Company specializing in hot dip galvanizing after fabrication and following the procedures of "Quality Assurance Manual" of the American Galvanizers Association.
- H. Provide certification that the galvanizing, primer, and top coats and their method of application are a compatible system.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications shall fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Verify all conditions for installation of the work.
- B. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for adjustments, trimming and fitting.

1.08 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this section but required for work of another section. Deliver such items to Project site in time for installation.

- C. Mount handrails only on completed walls or other construction. Do not support handrails temporarily by any means not satisfying structural performance requirements.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store fabricated components and materials in clean, dry locations, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation within covering.
- B. Handle metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

PART 2 PRODUCTS

2.01 FERROUS METALS

- A. Metal Surfaces, General:
 - 1. For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, stains, discolorations, and, for steel sheet, "oil canning" and variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
 - 2. Provide materials for galvanizing that are geometrically suitable for galvanizing as described in ASTM A384 and A385.
- B. Steel Plates, Shapes, and Bars: ASTM A36.
- C. Steel Tubing: Product type and as follows:
 - 1. Cold-Formed Steel Tubing: ASTM A500, Grade A, unless otherwise indicated or required for design loading.
 - a. Provide tubing with hot-dip galvanized coating per ASTM A53 or ASTM A385; inside and out for hollow tubing.
- D. Galvanized Steel Sheet: Quality as follows:
 - 1. Commercial Quality: ASTM A653, G90 coating designation unless otherwise indicated.
- E. Steel Pipe: ASTM A53; finish, type, and weight class as required; galvanized inside and out.
- F. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, galvanized.
- G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, shims as required per ASTM A153.
- H. Elastomeric Pads: Comply with Section 783 of the Standard Specifications.
- I. Gray-Iron Castings: ASTM A48, Class 30.

- J. Malleable-Iron Castings: ASTM A47, Grade 32510.
- K. Configuration of cross-hatch units, 3 inches wide.
- L. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallicly bonded to steel by a proprietary process. Abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder.
 - 1. Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W.S. Molnar Company; SlipNOT.
 - c. Approved equal.

2.02 STAINLESS STEEL

- A. Stainless Steel: Provide austenitic stainless steel in form and grade indicated complying with the following requirements:
 - 1. Tubing: ASTM A 554, Grades MT 301, MT 302, or MT 304, as standard with manufacturer.
 - 2. Pipe: ASTM A 312/A 312M, Grade TP 304.
 - 3. Plate and Sheet: ASTM A 167, Type 301, 302 or 304.
 - 4. Sheet, Strip, Plate, and Flat Bars: ASTM A666 Type 304 (or Type 316 for glazing stops only).
 - 5. Bars and Shapes: ASTM A 276, Type 304.
 - 6. Bar Stock: ASTM A 276.

2.03 BRACKETS

- A. Brackets for wall mounted railings to be as shown on drawings and constructed of same material as railings. Design of bracket to be code compliant and allow sufficient space between the wall and the rail. Bracket to be of welded construction and designed to meet all design loads. Allow for anchorage into the wall.

2.04 FASTENERS

- A. General: Provide Type 300 series stainless steel fasteners unless otherwise indicated or approved. Do not use metals which are corrosive or otherwise incompatible with metals joined. Select fasteners for the type, grade, and class required and for type of loading and installation condition shown or as specified by the manufacturer.
 - 1. Provide concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- B. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A (ASTM F568, Property Class 4.6), with hex nuts, ASTM A563 and, where indicated, flat washers. Stainless steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and where indicated, flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1.
- C. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8 M).

- D. Machine Screws: ANSI B 18.6.3 (ANSI B 18.6.7 M).
- E. Plain Washers: Round, carbon steel, ANSI B 18.22.1 (ANSI B 18.22 M).
- F. Lock Washers: Helical, spring type, carbon steel, ANSI B 18.21.1.
- G. Expansion Anchors: Anchor bolt and sleeve assemblies of type as required for installation condition shown; and of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
 - 1. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F593 and ASTM F594.
 - 2. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-325, Group VIII (anchors, expansion), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-575, Grade 5.
- H. Cast-In-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A153.
- I. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

2.05 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically specified by manufacturer for interior and exterior applications.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Nonshrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W. R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.
 - f. Five Star Grout; Five Star Products.
 - g. Vibropruf #11; Lambert Corp.
 - h. Crystex; L&M Construction Chemicals, Inc.
 - i. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - j. Sealtight 588 Grout; W. R. Meadows, Inc.
 - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
 - l. Kemset; The Spray-Cure Company.

2.06 WELDING

- A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded. Provide type and alloy of filler metal and electrodes as specified by producer of metal to be welded, complying with applicable AWS specifications, and as

required for color match, strength and compatibility in the fabricated items.

- B. All structural welds to be 3/16" fillet all around continuous welds unless noted or required otherwise. Ground smooth and flush all welds exposed to view unless noted otherwise.

2.07 GALVANIZING AND PAINT

- A. Hot-dip galvanize items as indicated to comply with ASTM A123, for galvanizing both fabricated and non-fabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strips 0.0299 inch thick and heavier. Comply with ASTM A153 for galvanizing steel and iron hardware.
- B. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint-20.
- C. Shop Primer for Ferrous Metal: Primer to be recommended for application over galvanizing and be manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field or shop applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.
- D. Zinc Chromate Primer: FS TT-P-645.
- E. Top Coats of Finish: Type, color, gloss and number of coats as approved by the Authority. Top coats of finish shall be heavy duty, suitable for application, and compatible with primer.
- F. Bituminous Paint: Cold-applied asphalt mastic complying with ASTM D 1187 and containing no asbestos fibers.

2.08 CAST ABRASIVE TREADS

- A. Treads and nosing of cast grey iron, Class 20, 11 inch by 3/8 inch (as shown on the drawings) treads with standard cross-hatched (1/16" deep "V" grooves) and non-skid abrasive aggregate wearing surfaces. Treads shall have plane beveled flanges as detailed with 1 inch nosing and as required by ICC/ANSI 2003. Units shall be free of surface irregularities, blow- holes and twists or bows which prevent required contact with supporting structure.
- B. Provide countersunk holes for 5/16" diameter fasteners with maximum 1/32"(+ or -) tolerance on pattern detailed. Provide 5/16" x 1-1/4" stainless steel screws with flanged locknuts.
- C. Aggregate shall be aluminum oxide or silicon carbide granules uniformly distributed and cast flush with wearing surface at average rate of 120 granules per square inch. Granule size range #16 to #24. Slip resistance to meet ADA and OSHA requirements.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. American Safety Tread Co., Inc.
 - 2. Barry Pattern and Foundry.
 - 3. Bridgeport Steel Sales.
 - 4. Safe-T-Metal Co.

5. Wooster Products Inc.
6. Approved equal.

E. Cast iron treads with grooves and/or non-skid abrasive aggregate wearing surfaces shall not be galvanized and/or painted.

2.09 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
1. Join components by welding, unless indicated otherwise.
 2. Use connections that maintain structural value of joined pieces.
 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- D. Form exposed work true to line and level with accurate angles, curves and surfaces and straight sharp edges. Form to required shapes and sizes. Finish exposed surfaces to smooth, sharp, well-defined lines and arises.
- E. Allow for thermal movement in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners.
- F. Cut, drill, shear and punch metals cleanly and accurately. Remove burrs.
- G. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- H. Remove sharp or rough areas on exposed surfaces.
- I. Weld corners and seams continuously to comply with AWS specifications and the following:\
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent. Grind exposed welds flush and smooth to match and blend with adjoining surfaces.
- J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated,

Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous. Cope or miter corner joints.

- K. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1 1/2 inches, with a minimum 6 inch embedment and 2 inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.
- L. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible.
- M. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- N. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.10 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish steel washers for heads and nuts.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Provide shop drawings showing applicable field verified sizes, details. Coordinate with supplier of equipment or product framing is supporting, if applicable.
- C. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long. Secure miscellaneous framing securely to structure by welding or anchoring as approved. Install to withstand all applicable loadings and stresses.

2.12 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work. Anchorages to be concealed unless approved otherwise.

- B. Galvanize miscellaneous steel trim, framing and supports after fabrication. Also prime and provide top coats for any exposed steel trim.

2.13 STEEL FRAMED STAIRS

- A. General: Construct stairs to conform to sizes, thicknesses, shapes, details and arrangements indicated. Follow approved shop drawings. Verify dimensions and conditions in field. Verify code requirements, performance requirements, and method of support. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, railings, newels, balusters, wire mesh panels, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
 1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for Architectural Class of stair except where more stringent requirements are indicated.
 2. Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces. Provide minimal gap for drainage between panels and treads and risers.
 3. Provide stiffener plates, bracing and additional framing to resist torsion, and properly secure stairs to the structural elements.
- B. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers, newels, and framing members to strings and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.
- C. Treads and Landings: Fabricate treads and landings as shown on the drawings and specified herein and assemble as shown on the drawings. Unless shown otherwise on the drawings, form treads and platforms of 3/8 inch thick cast iron floor plate. Attach treads and platforms to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach treads to brackets by bolting, as indicated. Provide continuous solid steel front or risers, and rear plates under the treads as detailed on drawings.
- D. Stair Railings and Handrails: Comply with applicable requirements specified elsewhere in this section for steel railings and handrails. Connect railing posts to stair framing by direct welding, unless otherwise indicated.
- E. Hot dip galvanize stair assemblies and rail assemblies after fabrication. Then apply primer and top coats in the shop. Platforms of ferrous metal to be galvanized separately prior to installation of non-skid abrasive wearing surface. Galvanizing to not fill the cross hatched 1/16" AV@ grooves.

2.14 RAILINGS, HANDRAILS, AND BARRIERS

- A. General: Fabricate railings, handrails, cane rails, and barriers to comply with requirements indicated for their design, dimensions, heights, details, finish, and member sizes, including thickness, profiles, post spacings, and anchorage, but not less than that required to support structural loads. Form to required shapes and sizes, with true curves, lines and angles. Design to follow approved shop drawings. Also, verify that installations will meet all applicable building codes and ADA requirements. For fabrication, follow approved shop drawings for design, sizes, heights and details. Assemble components at right angles, straight, flush and with equal spacing. Shop drawings to indicate actual field

verified dimensions, details, and conditions.

- B. Fabricate from structural tubing, bar and plate as indicated. Miter corners to provide tight joints.
- C. See drawings for those railings, handrails, and barriers to be fabricated of ferrous metal.
- D. Interconnect railing, handrail, and barrier with full butt welds unless otherwise indicated. At tee and cross intersections, notch ends of intersecting members to fit contour to which end is joined and weld all around. All joints to be tight and smooth. Members to be parallel and perpendicular to each other. Miter and weld joints and connections to form solid joints. Grind and smooth all welds.
- E. Changes in direction of railing members to be formed by mitering and welding; or, if indicated, railings to be bent at corners, rail returns, and wall returns.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- G. Unless indicated otherwise, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or, if not indicated, use 4 inches high x 1/8 inch steel plate welded to, and centered between, each railing post.
- H. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors as required for interconnections of members and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work. Secure railings and barriers securely to structure (floor, walls, columns).
 - 1. For railing posts set in concrete provide preset sleeves of Schedule 80 steel pipe, not less than 6 inches long and with inside dimensions not less than 2 inch greater than outside dimensions of post, with steel plate forming bottom closure.
- I. Fasteners: Provide fasteners fabricated from type 304 or type 316 stainless steel. Do not use metals that are corrosive or incompatible with materials joined. Provide concealed fasteners except where welded or where exposed fasteners are unavoidable or are the standard method of fastening. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- J. Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and over-stressing of substrate.
- K. Material for sleeves, flanges, wall returns, wall brackets, end closures, toe boards, miscellaneous fittings and anchors: Provide of same material as railings and barriers; ferrous metal.
- L. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature, in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints and over-stressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss. Temperature Change (Range); 100 deg F, (55.5 deg C).
- M. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with in compatible materials.

- N. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners when possible.
- O. Comply with AWS for specified practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux, and dress on all exposed and contact surfaces. Grind exposed welds flush and smooth to match and blend with adjoining surfaces. Weld continuously along entire line of contact unless spot welding is indicated.
- P. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- Q. Provide castings that are sound and free of warp or defects which impair strength and appearance.
- R. Finish exposed surfaces to smooth, sharp, well-defined lines and arises.
- S. Preassemble items in shop to greatest extent possible to minimize splicing and assembly of units at project site. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

2.15 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Hot dip galvanize stair and non-stainless steel rail assemblies, including framing, supports, tread supports, stair stringers, rough hardware and trim after fabrication. For galvanized metal exposed to view after installation, apply primer and top coats in the shop; touch-up in the field.
 - 1. Do not galvanize or paint cast abrasive treads, landings, and platforms.
 - 2. See Painting Section of these specifications for primer and top coats over galvanized metal.
- C. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: Galvanize all items fabricated from ferrous metal. Apply zinc-coating by the hot-dip process after fabrication of assemblies. See Section 05030 "Hot Dip Galvanizing" and galvanize in compliance with the following requirements:
 - 1. ASTM A153 for galvanizing iron and steel hardware.
 - 2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Preparation for Galvanizing: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. SSPC Zone 1B: SSPC-SP6 "Commercial Blast Cleaning."
- C. Where steel is to also be finished with primer and top coats, apply shop primer to

galvanized surfaces of metal fabrications, except portions to be embedded in concrete or masonry. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

2.17 STAINLESS STEEL FINISHES

- A. Finish designations prefixed by AISI conform with the system established by the American Iron and Steel Institute for designating finishes for stainless steel sheet.
- B. Satin Finish: AISI No.4 polished, directional texture to match approved sample. Direction of texture shall be parallel to the long dimension of the member or surface.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.
- C. Field verify all dimensions and conditions for the installation of all metal fabrications. Coordinate with approved shop drawings.

3.02 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required. Secure to meet all design loading and stresses.
 - 1. Except where otherwise shown or specified, fasten metal fabrications to solid concrete or masonry with expansion bolts.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of metal items, restore finishes to eliminate any evidence of such corrective work.
- E. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections. Grind exposed welded joints smooth and restore finish to

match finish of adjacent surfaces.

- F. Field Welding (when approved by the Authority): Comply with applicable AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld connections which cannot be shop welded because of shipping size limitations.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- G. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.
- H. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.
1. Paint the contact surfaces of dissimilar materials and metal in contact with masonry or concrete work, with a heavy coating of epoxy paint.

3.03 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing steel stairs to in place construction. Include threaded fasteners for concrete inserts, through-bolts, lag bolts, and other connectors as required; weld stair framing to steel structure.
- B. Set steel stair base plates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge or bearing plate.
- C. If stair is to be set into concrete, pack voids solid with nonmetallic, nonshrink grout after installation.
- D. Install stair units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.
- E. Center nosings on tread widths with nosings flush with tread surfaces.

3.04 INSTALLATION OF RAILINGS, HANDRAILS, AND BARRIERS

- A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
1. Anchor posts in concrete by core drilling holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's directions.

2. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
 3. Anchor rail ends into concrete and masonry with steel flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
 4. Anchor rail ends to steel with steel flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.
- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Use type of bracket with pre-drilled hole for exposed bolt anchorage.
 3. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
 4. For hollow masonry anchorage, use toggle bolts having square heads.
- C. Align rails so that variations from level for horizontal members and from parallel with rake of steps for sloping members do not exceed 1/4 inch in 12 feet. Align at abutting joints.
- D. Welded Connections: Use fully welded joints; cope or butt components to provide full contact. At exposed welded connections, finish exposed welds and surfaces smooth and blended so that no roughness is evident (by sight or touch) after finishing, and welded surface matches contours of adjoining surfaces.
- E. Expansion Joints: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.
- F. Install railings, cane rail, barriers and gates as shown on drawings. Install all hardware for gate, provide all required accessories, and make all necessary adjustments.
- G. Installation to be rigid, straight, level, and secure. Installation to meet all applicable codes. Touch up any paint finish after installation.

3.05 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.
- C. Clean stainless steel with soap and water; rinse with clear water.

3.06 FINISHES

- A. Unless fabricated of prefinished material or stainless steel, all metal fabrications to be hot dip galvanized in the factory after fabrication per referenced standards.
- B. For fabrications exposed to view, finish galvanized fabrications in the shop, if possible, by cleaning galvanized surfaces, priming and application of finish coats. Follow paint

manufacturer's recommendations. See Painting Section of these specifications for painting system. Touch up any welded or otherwise damaged galvanized surfaces with galvanizing repair paint prior to prime and finish coats.

- C. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum 3.0 mil dry film thickness.

3.07 PROTECTION

- A. Protect finishes of metalwork from damage during construction period by use of temporary protective coverings approved by fabricators. Remove protective covering at time of substantial completion.
- B. For pre-finished surfaces, restore protective coverings which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
- C. Restore finishes damaged during installation and construction period so that no evidence remains of corrective work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION 05 50 40

SECTION 05 70 00
DECORATIVE METAL PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section includes decorative metal fabrications including:
1. Exterior Insulated Stainless Steel Infill Panels.
 2. Exterior Insulated Stainless Steel Wall Panel Systems including panel framing.
 3. Exterior Stainless Steel Cladding of steel framing members.
 4. Interior 6" Wide Ceiling Linear Perforated Pre-Finished Galvanized Acoustic Metal Panels under Translucent Canopy Roof System where indicated.

1.03 RELATED WORK

- A. Section 05 50 00, Metal Fabrications
- B. Section 07 21 00, Building Insulation

1.04 REFERENCES

- A. AAMA 501.2 - Hose Testing - Methods of Test for Exterior Walls (part of AAMA 501).
- B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
- C. ANSI/DHI A115.IG - Installation Guide for Doors and Hardware.
- D. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- F. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
- G. AWS D1.1 - Structural Welding Code—Steel.
- H. AWS D1.3 - Structural Welding Code--Sheet Steel.
- I. AWS D1.6 - Structural Welding Code--Stainless Steel.

1.05 PERFORMANCE REQUIREMENTS

- A. General: Provide wall panel systems, windbreaks, including anchorage, capable of withstanding, without failure the effects of the following:
1. Structural loads.
 2. Thermal Movements.
 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated

live loads.

4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following

- a. Deflection exceeding specified limits
- b. Thermal stresses transferred to building structure.
- c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
- d. Noise or vibration created by wind and thermal and structural movements.
- e. Loosening or weakening of fasteners, attachments, and other components.
- f. Failure of operating units to function properly.

B. Structural Loads:

1. Wind Loads: In accordance with latest Chicago Building Code requirements, and ASCE 7, Minimum Design Loads for Buildings and Other Structures, Current Edition.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual panels to 3/4 inch, whichever is less.
2. Deflection Parallel to Panels: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

D. Thermal Movements: Provide stainless steel wall panel system, windbreaks, and other decorative metals that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees Fahrenheit ambient; 180 degrees Fahrenheit, material surfaces.
2. Test performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. Test High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 degrees Fahrenheit.
 - b. Test Low Exterior Ambient-Air Temperature: 0 degrees Fahrenheit.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated, including finishing materials.
- B. Shop Drawings: For decorative metal. Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
 1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design

- D. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Qualification Data: For Installer and fabricator.
- G. Furnish engineering calculations for wall panels systems, guardrails, windbreaks, and other decorative metals where performance requirements are given as prepared by a structural engineer licensed in the State of Illinois and as required by IDOT, showing that maximum stresses and deflections do not exceed specified performance requirements under full design loading. Calculations shall be prepared and sealed by a structural engineer licensed in the State of Illinois.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Arrange for installation of decorative metal specified in this Section by the same firm that fabricated it.
- B. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Welding: Qualify procedures and personnel according to AWS Specifications.
- D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01200, Project Meetings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 METALS, GENERAL

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 20 percent.
- B. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.02 HOT DIP GALVANIZING, GENERAL

- A. Provide and install hot dip galvanized decorative metal ceiling panels where indicated on drawings.
- B. The fabricator shall comply with detailing recommendations contained in the American Galvanizers Association publication, "The Design of Products to be Hot Dip Galvanized After Fabrication."
- C. Detailing shall eliminate the need for field welding of hot dip galvanized fabrications.

2.03 LINEAR CEILING PANEL SYSTEM

- A. Pre-finished galvanized linear metal panels
 - 1. Typical size: As indicated on the Drawings.
 - 2. Refer to drawing for exact configuration and location.
 - 3. Rigid insulation above – see Spec Section 07 21 00

2.04 INSULATED WALL PANEL SYSTEM

- A. Galvanized Channel and Hat Shaped Framing:
 - 1. Typical size: As indicated on the Drawings.
 - 2. Refer to drawing for exact configuration and location.
- B. Insert Panels:
 - 1. Insulated stainless steel metal panels.
 - 2. Refer to Drawings for panel configurations and locations.
 - 3. Refer to Wall Panel Schedule on the Drawings for description of panel materials and assemblies.
- C. Stainless-Steel-Wrapped Steel Members
 - 1. Wrap steel members with stainless steel of gauge metal as indicated on drawings,

2.05 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for

anchoring indicated items to other types of construction indicated.

- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work, unless otherwise indicated.
 - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.07 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly, mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- F. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- G. Provide weep holes where water may accumulate.
- H. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items, unless otherwise indicated.

2.08 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable,

temporary protective covering before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation; measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

D. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

E. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

F. Install concealed gaskets, joint fillers, and flashings as work progresses.

G. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

H. Field Welding: Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces. Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base materials.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface

matches those adjacent.

- I. Provide separation between dissimilar materials, if required.

3.03 ADJUSTING AND CLEANING

- A. Final Adjustments for Doors (Gates)
 - 1. Check and readjust operating hardware items just before final inspection.
 - 2. Leave work in complete and proper operating condition.
 - 3. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

3.04 PROTECTION

- A. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 70 00

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Provide lumber and plywood for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, backer boards, stripping, and similar members. All rough carpentry shall be fire retardant treated exterior type.

1.03 DEFINITIONS

- A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed to view, unless otherwise specified.

1.04 SUBMITTALS

- A. General: Submit the following:
- B. Product data for engineered wood products, sheathing, underlayment, metal framing anchors.
- C. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.
- D. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
 3. For fire-retardant treated wood products include certification by treating plant that treated material complies with specified standard and other requirements.
 4. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant treated wood products with requirements indicated.
 5. Warranty of chemical treatment manufacturer for each type of treatment.

1.05 QUALITY ASSURANCE

- A. Single-Source Responsibility for Fire-retardant Treated Wood: Obtain each type of fire-retardant treated wood products from one source for both treatment and formulation.
- B. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory shall demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the progress of

the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 PRODUCTS

2.01 LUMBER, GENERAL

- A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill. For exposed lumber furnish pieces with grade stamps applied to ends or back of each piece; or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
- E. Unless indicated otherwise, provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for all lumber and boards.
- F. Provide dressed lumber, S4S, unless otherwise indicated.
- G. Grade: "Standard" grade lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WWPA rules or "No. 2 Grade Boards" per SPIB rules.
- H. Provide untreated timber for Temporary Shoring where indicated.

2.02 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGR's of any species. For board-size lumber, provide No. 3 Common grade per NELMA,

NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.03 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Where rough carpentry is exposed to weather, near or in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power Driven Fasteners: National Evaluation Report NER-272.
- D. Wood Screws: ANSI B18.6.1.
 - 1. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.
- E. Screws: For decking shall be No. 10 stainless steel flat head wood screws with sufficient length to penetrate at least 1-1/4" minimum into supporting member. Follow manufacturer's recommendations.

2.04 FIRE-RETARDANT-TREATED MATERIALS

- A. Provide materials that comply with performance requirements in AWWA C20 for lumber and AWWA C27 for plywood. Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664 for lumber and ASTM D 5516 for plywood.
 - 2. Use treatment that does not promote corrosion of metal fasteners.
 - 3. Use exterior type.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated or nailing or fastening schedules for specific building code.
- E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not

penetrate through members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, and blocking where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Attach wood nailers at roof level with anchor bolts at 4'-0" centers, anchored to roof structure 5/8" dia. unless noted otherwise. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install wood furring plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION 06 10 00

SECTION 07 11 50
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes cold-applied, emulsified- asphalt dampproofing applied to the following surfaces:
 - 1. Exterior, below-grade surfaces of concrete foundation walls.
 - 2. Exterior of elevator pits.

1.03 RELATED WORK

- A. Section 14 21 00, Traction Elevators.

1.04 REFERENCES

- A. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
- B. ASTM D1668 -Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
- B. Material Certificates: For each product, signed by manufacturers.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.07 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturer's written instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cold-Applied, Emulsified-Asphalt Dampproofing:
 - 1. Karnak Corporation.
 - 2. Koppers Industries, Inc.
 - 3. Meadows, W. R., Inc.
 - 4. Sonneborn, Div. of ChemRex, Inc.
 - 5. Tamms Industries.
 - 6. Or approved equal.

- B. Protection Course, Asphalt-Board Type:
 - 1. Grace, W. R. & Co.; Construction Products Div.
 - 2. Meadows, W. R., Inc.
 - 3. Sonneborn, Div. of ChemRex, Inc.
 - 4. Or approved equal.

2.02 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Emulsified-Asphalt Dampproofing:
 - 1. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.
 - 2. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.03 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

- B. Asphalt-Coated Glass Fabric: ASTM D1668, Type I.

- C. Protection Course, Asphalt-Board Type: Pre-molded, 1/8inch- thick, multi-ply, semi-rigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 - 1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.03 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverage's indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
- B. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior whether indicated or not.
 - 1. Apply from finished-grade line to top of footing; extend over top of footing, and down a minimum of 6 inches over outside face of footing.
 - 2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inchwide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Use cold-applied, emulsified-asphalt dampproofing on any surface indicated to receive dampproofing.
- B. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, one fibered brush or spray coat at not less than 3 gal./100 sq. ft., or one trowel coat at not less than 4 gal./100 sq. ft.

3.05 INSTALLATION OF PROTECTION COURSE

- A. When indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturers written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.06 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07 11 50

SECTION 07 21 00
BUILDING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following, when shown on the drawings:

1. Rigid insulation for wall and roof/ ceiling assemblies.
2. Vapor barriers.

1.03 RELATED WORK

- A. Section 05 50 00 Metal Fabrications
- B. Section 07 60 00, Flashing and Sheet Metal
- C. Section 07 90 00, Joint Sealants

1.04 REFERENCES

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- C. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- F. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees Celsius.

1.05 DEFINITIONS AND DESIGN REQUIREMENTS

- A. Thermal Resistance (R-value): The temperature difference in degrees F between the two surfaces of a material of given thickness, required to make 1 Btu of energy flow through 1 sq. ft. of the material in 1 hour.

1.06 SUBMITTALS

- A. Product data and specifications for each type of insulation and vapor barrier product specified. Include product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of insulation products with requirements including r-values (aged values for plastic foam insulations), fire performance characteristics, perm ratings, water absorption ratings, and other properties,

based on comprehensive testing of current products.

- B. Manufacturer's Instructions: Obtain and submit manufacturer's instructions for installation of products in specific applications indicated for this project. If preprinted instructions do not clearly establish installation procedures applicable to project conditions, submit manufacturer's instructions prepared specifically for this project.

1.07 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristic: ASTM E84.
 - 2. Fire Resistance Ratings: ASTM E119.
 - 3. Combustion Characteristics: ASTM E136.
- B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- C. Installer's Qualifications: Firm regularly engaged in installation of products specified in this section, with minimum 5 years' experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 PRODUCTS

2.01 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.
- B. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths and lengths.
- C. Provide manufacturer's standard preformed insulation units, sized for proper fit in indicated applications.

2.02 RIGID INSULATION

- A. Extruded Polystyrene Board Insulation: Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C578 for Type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 degrees Fahrenheit (4.4 and 23.9 degrees Celsius), respectively; and as follows:
 - 1. Type IV, 1.6 lb./cu. ft. min. density, unless otherwise indicated.
 - 2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 5 and 165, respectively.

2.03 VAPOR RETARDERS

- A. Polyethylene Vapor Retarder: ASTM D4397, 6 mils thick, with maximum permeable rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.04 AUXILIARY INSULATING MATERIALS

- A. Provide accessories as necessary to properly install specified products.
- B. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer, and complying with requirements for fire performance characteristics.
- C. Crack Sealer for Board Insulation: Provide polymeric insulating foam in aerosol dispenser designed for filling voids in board insulation. Subject to compliance with requirements, provide "Polycel 100" by Construction Products Div., W.R. Grace & Co., or approved equal.

2.05 MANUFACTURERS

- A. Manufacturers of Extruded Polystyrene Board Insulation:
 - 1. Dow Chemical U.S.A.
 - 2. Pactiv.
 - 3. Owens-Corning.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions conform to requirements of contract documents.
- B. Verify that related work to be performed within indicated spaces before installation of insulation has been completed.
- C. Verify that substrates are in satisfactory condition to receive insulation.
- D. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean substrates of any substances that might damage materials to be installed.

3.03 INSTALLATION OF INSULATION

- A. Do not install insulation which is damaged, wet, soiled, or which has been covered at any time with ice or snow.
- B. Comply with insulation manufacturer's recommendations and installation sequence. Provide permanent placement and support of insulation.
- C. Install materials in a manner that will maximize continuity of thermal envelope. Use a

single layer of insulation wherever possible to achieve indicated requirements, unless otherwise indicated.

- D. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement. Tape at joints, seams, and holes. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Firmly secure in place with anchorage system as indicated and as recommended. Extend vapor barrier to cover miscellaneous voids in insulated substrates.
- B. Locate all joints over framing members for attachment. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches on center. Seal overlapping joints in vapor retarders with vapor-retarder tape according to manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.05 PROTECTION

- A. Protect installed insulation and vapor retarders materials from damage due to harmful weather exposures, physical abuse, and other causes until permanent concealing work is completed.
- B. Where concealing work is not performed immediately after installation work of this section is completed, erect suitable temporary coverings or enclosures to prevent damage.

END OF SECTION 07 21 00

SECTION 07 41 50
ALUMINUM ROOF PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes providing all labor, materials, and equipment to provide aluminum roof panels matching existing:
1. New preformed pre-finished aluminum profile roof panels.
 2. Aluminum trim, fascia, and other accessories.

1.02 RELATED WORK

- A. Related Sections: The following sections contain requirements that relate to this Section:
1. Section 05 10 30 - Structural Steel
 2. Section 05 31 00 – Steel Deck
 3. Section 07 60 00 – Flashing and Sheet Metal
 4. Section 07 92 00 – Joint Sealers

1.03 REFERENCES

- A. American Iron and Steel Institute (AISC): "Specification for the Design of Cold-Formed Steel Structural Members".
- B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): "Architectural Sheet Metal Manual".
- C. Steel Deck Institute Inc. (SDI): "SDI Design Manual for Composite Decks, Form Decks and Roof Decks".
- D. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvanealed) by the Hot-Dip Process.
- E. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.04 SUBMITTALS

- A. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.
- B. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for panels with factory-applied finishes.
- C. Samples for verification purposes of roof panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Including but not limited to trim, sills, ridge pieces, flashing, clips, fasteners, fillers, closures, and other panel accessories.
- D. Furnish shop drawings for the fabrication and installation of the metal roof panel system. Prepare details at not less than 3" = 1'-0" minimum scale. Include layout plan showing

roof panel lengths locations of lap joints between panels. Indicate radius required of panels. Provide shop drawings for all accessories including closure strips, supports, trim, flashing, etc. Indicate field verified dimensions, conditions, and support for new panels. Indicate materials and finishes. Show typical details of the conditions for every member, joint, anchorage and support in the system.

- E. Structural Calculations: Furnish engineering calculations to show that maximum stresses and deflections do not exceed specified performance requirements under full design loading.
- F. Maintenance Manuals: Furnish complete manuals describing the materials, devices, and procedures to be followed in cleaning and maintaining the Work. Include manufacturer's brochures and parts lists describing the actual materials used in the work, including metal alloys, finishes, and major components. Assemble manuals for component parts into single binders identified for each system.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design Load and Deflection: Design, fabricate and install component parts so that the completed Work shall withstand inward and outward loading applied normal to the plane of metal roofing panels with deflection not exceeding 1/240 of the clear span between supports.
 - 1. Wind Load 30 PSF.
 - 2. Snow Load 25 PSF.
 - 3. Point Load 200 Pounds.
- B. Design Factor of Safety: Design, fabricate and install component parts of Work, including roofing panels and connections, with a factor of safety not less than 1.5, such that failure of any component shall not occur at less than 1.5 times the maximum design load, except where more stringent requirements are specified. Failure is defined as breakage, component disengagement, or permanent distortion in excess of 0.2% of the span of each member.
- C. Building Movement: Design, fabricate and install the Work to withstand building movements including thermal movements, loading deflections and similar movements. Engineer will furnish specific data on anticipated building movements as may be requested by Contractor.
- D. Thermal Movement: Design, fabricate and install the Work to withstand expansion and contraction forces resulting from a 120oF ambient temperature range of -20oF to +100oF, which may result in exterior metal surface temperature exceeding 180oF.

1.06 QUALITY ASSURANCE

- A. Standards: Comply with applicable requirements and details of AISC "Specification for the Design of Cold-Formed Steel Structural Members", SMACNA "Architectural Sheet Metal Manual" and SDI "SDI Design Manual for Composite Decks, Form Decks and Roof Decks".
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- C. Wind Uplift: Provide roof panel system including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance.

- D. Field Measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.
- E. Structural Design: Panels must be designed to support snow and wind loads as defined by the local building code for the supports spaced as shown on the Drawings. Deck profile, type, depth, and thickness to be selected to provide superimposed design loads required and as determined using SDI Design Manual No. 30 construction loading criteria. Provide test data or calculations signed by a Structural Engineer, licensed in the state of Illinois.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package roof panels for protection against transportation damage including damage to the surface.
- B. Handling: Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather-tight ventilated covering. Store metal roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.08 WARRANTY

- A. Warranty: Furnish 10 year written warranty from date of final acceptance, signed by the Contractor and Installer, agreeing to repair or replace Work which has leaked or otherwise failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Authority.
- B. Factory Finish Warranty: Furnish manufacturer's 20 year written warranty, stating that the factory applied finishes will not develop excessive fading or excessive non-uniformity of color or shade, and will not crack, peel, pit, corrode, or otherwise fail as a result of defects in materials or workmanship within the following defined limits. This warranty shall be in addition to and not a limitation of other rights the Authority may have against the Contractor under the Contract Documents. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Authority.
 - 1. "Excessive Fading": A change in appearance which is perceptible and objectionable as determined by the Engineer when visually compared with the original color range standards.
 - 2. "Excessive Non-Uniformity": Non-uniform fading to the extent that adjacent panels have a color difference greater than the original acceptable range of color.
 - 3. "Will Not Pit or Otherwise Corrode": No pitting or other type of corrosion, discernible from a distance of 10', resulting from the natural elements in the atmosphere at the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal roof panel systems that may be incorporated in the work include but are not limited to the following:

1. Steel Roof Panels:
 - a. AEP-Span.
 - b. Allied Roof System.
 - c. Architectural Panels, Inc.
 - d. ASC Pacific, Inc.
 - e. Atas Aluminum Corp.
 - f. Berridge Manufacturing Co.
 - g. Building Components, Inc.
 - h. Butler Manufacturing Co.
 - i. Centria Architectural Systems.
 - j. Consolidated Systems, Inc.
 - k. Epic Metals Corporation.
 - l. Metal Building Components, Inc. (MBCI).
 - m. Merchant & Evans, Inc.
 - n. Petersen Aluminum Corp.
 - o. Roof Deck Inc.
 - p. United Steel Deck, Inc.
 - q. Vincent Metals.
 - r. Or Approved Equal.

2.02 PANEL MATERIALS

- A. Structural Quality Aluminum Sheet: ASTM B 209, Alloy 5005 with temper as required to suit forming operations and structural performance required. Factory formed to profile indicated; pre-finished all sides.

2.03 ROOF PANELS

- A. Standing-seam roof panels: Manufacturer's standard factory-formed lap-seam panel system designed for mechanical attachment of panels to steel deck using concealed fasteners to greatest extent possible. Comply with ASTM E 1514. Form panels of aluminum-zinc alloy- coated steel sheet, 0.040 inch thick factory finished after fabrication. Roof panels shall be continuous lengths without lap seams. Provide 1-½" deep profile with rib spacing at 7.2" o.c. or as approved by the Authority.
1. Metal to be cleaned, pretreated, and painted in accordance with deck and coating manufacturers' recommendations.
 2. Thickness as indicated or as required for design loading.
 3. Span Condition: Single Span.
 4. Side laps: Deck shall have full-depth side laps that can be mechanically fastened together.
 5. Edges must be able to receive trim pieces; trim pieces by panel manufacturer.
 6. Rating: UL Classified 90 rated (wind uplift) panel assembly.
 7. Flashing and Trim: thickness and finish to match panels.
 8. Fasteners: Manufacturer's standard to obtain the required performance, stainless steel, finish to match panels.
 9. Texture: Smooth.
 10. Panel Dimension: Manufacturer's standard.
 11. Panel Depth: 2".
 12. Panel Type: Continuous dovetail-shaped ribs spaced 6 1/8 inches on center.
 13. Rib Opening at Bottom: ½ inch.
 14. Rib Width at Top: 1 ½ inches.

15. Panel Cover Width: 24 ½ inches.

- B. Provide all related and required matching trim, closure pieces, ridge pieces, flashing, and other accessories for a complete roof system. Finish to match roof panels.

2.04 METAL FINISHES

- A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Panels to be pre-finished in the factory.
- B. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish.
- C. Finish for metal roof panels:
1. Class I, Color Anodized Finish: Mechanical finish, nonspecular as fabricated, chemical finish, etched, medium matte, anodic coating, Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker complying with AAMA 611.
- D. All surfaces (top, bottom, sides and edges) for all panels and accessories to be finished with above specified finish and finish coat color as selected by Authority from manufacturer's standards.

2.05 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Type 300 series stainless steel fasteners.
1. Provide exposed fasteners with heads matching color of roof panel by means of plastic caps or factory-applied coating.
 - a. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
 - b. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
- B. Accessories: Except as indicated as work of another specification section, provide pre-finished components required for a complete roof panel system, including trim, sills, ridge pieces, clips, flashing, louvers, sealants, gaskets, fillers, closure strips, and similar items. Accessories as required by manufacturer of roof panel system and as shown on approved shop drawings. Match materials and finishes of panels.
1. Provide metal flashing, closure pieces, trim and other pieces to match panels to provide for water runoff and prevent leakage at changes of direction, angles, joints between panels, where panels meet walls, and other surfaces, and other locations. Detail system and provide accessories for a water tight installation.
 2. Flexible Closure Strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyolefin foam flexible closure strips. Cut or pre-mold to match configuration of roofing panels. Provide closure strips where indicated or necessary to ensure weather-tight construction.
 3. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.

4. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as specified by the building manufacturer. Installation shall comply with requirements of Division 07, Section "Joint Sealers" of these specifications.
5. Concealed sealants and gaskets: Manufacturer's standard.

2.06 PANEL FABRICATION

- A. General: Fabricate and finish roof system panels and accessories at the factory as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.
- B. Curved roof panels shall be pre-formed to required radius in single piece full length panels with no seams as indicated on the Drawings. Verify radius in field for each site.
 1. Coat all exposed and cut or drilled edges with rust-inhibitive coating system to match existing including touch up repair and finish paint.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Steel deck to be securely installed and clean, ready to receive new metal canopy panels.

3.02 INSTALLATION

- A. General: Comply with manufacturers' instructions and specifications to achieve a watertight installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement. Coordinate work with substrate installation.
 1. Field cutting of exterior panels by torch is not permitted.
 2. For panels installed with exposed fasteners, the fasteners are to be pre-finished to match panel finishes.
 3. Provide for drainage by sloping panels as indicated on drawings or as otherwise required.
 4. Provide separation between dissimilar metals.
- B. Fastening: Fasten through material laps. Secure roof panels to metal deck according to fastening schedule, as shown on shop drawings, as recommended by manufacturer, and as required to meet code and wind requirements. Use approved fasteners of type and of sufficient length to penetrate the roof panels and secure the metal roof panels to the structure to meet all requirements.
- C. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw, threads, or roof panels.
 1. Spacing of fasteners per manufacturer's recommendations for actual conditions and design criteria. Provide fastening along perimeters.

- D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1 ½ inches. Lap joints to be lapped 2 inches minimum.
- E. Provide weatherproof escutcheons for pipe and conduit penetrating material, if any.
- F. Accessories: Install components as required in manufacturers' instructions for a complete roof panel system.
 - 1. Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to roof panel manufacturer's written instructions, mechanically fastened to roof panels.
- G. Coordinate installation of sheet metal fascia and other items at roof and as a part of the metal roof system.
- H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of roof panels, and support of other work.
- I. Joint Sealers: Install gaskets, joint fillers, and sealants for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types specified by panel manufacturer.
 - 1. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
 - 2. Installation shall comply with requirements of Division 07, Section "Joint Sealers" of these specifications.
- J. Provide sealant tape at lapped joints of ribbed or fluted roof sheets and between roof sheets and protruding equipment, vents, and accessories.
- K. Apply a continuous ribbon of sealant tape to clean, dry surface of the weather side of fastenings on end laps, side laps, at lapped joints of corrugated nesting-type, ribbed or fluted roof panels and elsewhere as needed to make roof sheets weatherproof to driving rains.
- L. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20'-0" on level/plumb/slope and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.03 CLEANING AND PROTECTION

- A. Damaged Units: Touch-up marred or abraded surfaces. Replace roof panels or accessories and other components of the work that are bent, dented or otherwise have been damaged or have deteriorated beyond successful repair by means of minor repair procedures. Re-solder loose, thin, or leaking joints or connections.
- B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as specified by panel manufacturer, and maintain in a clean condition during construction.

END OF SECTION 07 41 50

SECTION 07 52 50
MODIFIED BITUMINOUS SHEET ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide and install new roofing system consisting of four (4) ply bituminous (three (3) plies of Type VI Felts and one (1) ply SBS Type Granular Surfaced Modified Bitumen Membrane top sheet) roofing over new Perlite or recover board and over new insulation laid over the roof deck (new roof or tear off existing roof).
- B. Provide and install new three (3) ply flashing where required (two (2) plies of Type VI Felts and one (1) ply SBS Type Modified Bitumen).
- C. Provide and install new pre-finished aluminum coping or gravel stop at roof edge to replace existing. Provide and install new pre-finished aluminum flashing, counterflashing, trim and accessories to match existing and as required. Provide and install new roof specialties where indicated.
- D. Provide and install new stainless steel coping or gravel stop at roof edge.
- E. Replace roof drains with new roof drain covers.
- F. Any other equipment, material, labor to complete the entire roof system installation as shown on the drawings and required for a complete, water tight and warranted installation.

1.02 RELATED WORK

- A. Related Documents
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 07 60 00 – Flashing and Sheet Metal

1.03 QUALITY ASSURANCE

- A. Manufacturer: Modified Bituminous Sheet Roofing Manufacturer specializing in manufacturing the products specified in this Section with minimum twenty (20) years experience.
- B. Applicator: Company specializing in applying modified bituminous sheet roofing with minimum ten (10) years documented experience of projects of similar size and complexity and approved by materials manufacturer.
- C. Applicator shall have applied accepted roofing system on two or more projects, similar size or larger, which have performed satisfactorily for at least ten (10) years.
- D. Apply roofing system (insulation, roofing membranes, and flashing) in strict accordance with this and approved manufacturer's written specifications.
- E. Provide roofing system (materials and installation) that comply with the fire rating complying with ASTM E 108, Class A fire performance for FM-approved class 1 roof covers and the wind uplift requirements of Classification 1A-60. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

- F. Provide Modified Bitumen Roof Membrane that meets City of Chicago Energy Code.

1.04 SUBMITTALS

- A. Submit certificate, stating that roof applicator is an approved roofing contractor of the manufacturer of the roofing system.
- B. Submit prior to fabrication, delivery or installation:
 - 1. Latest edition of manufacturer's literature and specifications for roofing felts, base flashing and bitumen specification, which covers materials and installation instructions.
 - 2. Latest edition of manufacturer's literature and specifications for insulation and recover boards and anchorage materials for insulation and recover boards, which covers materials and installation instructions.
 - 3. List of materials proposed for use and certificates that materials comply with ASTM Specifications, required fire ratings, applicable codes, energy code, and other requirements. Products include insulation, recover board, felts, SBS top membrane, flashing, primer, asphalt, fasteners. Provide type of asphalt for each application.
 - 4. Provide manufacturer's description and details for entire roofing system. Provide installation recommendations and instructions for roofing system.
 - 5. Provide certification that proposed installation complies with all requirements and codes, including wind requirements.
 - 6. Provide data for each type of asphalt proposed to be used.
- C. Provide shop drawings for the roof installation including a plan of the roof showing slopes, drains, dimensions, obstructions, roof mounted equipment, expansion joints, vents, skylights, hatches, openings and other items; details for installation and flashing; details for roof mounted accessories; curb details; parapet and roof edge details; and other details and sections. Show a plan for the insulation board and recover board installation; fastening spacing for each layer and indicating the location of joints for each layer of insulation and recover board.
- D. Submit a copy of the manufacturer's warranty as specified herein.
- E. Provide one foot square samples of insulation, recover board, felt, membrane, membrane flashing.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers and rolls with labels intact and legible.
- B. Handle rolled goods so as to prevent damage to edge or ends.
- C. Store felts, base flashing and insulation on clean raised platforms with weather protective covering when stored outdoors.
- D. Store rolled goods on end.
- E. Select and operate material handling equipment so as not to damage existing construction or applied roofing.
- F. Do not leave unprotected materials on roof overnight.
- G. Protect materials and installed roofing against damage by construction traffic.

- H. Remove wet or damaged materials from project site.
- I. Comply with local fire and safety regulations.
- J. Comply with OSHA safety regulations.
- K. Store emulsions at temperatures above 40 degrees F.
- L. Do not store materials on roof decks, nor position roofing installation equipment on roof decks, in concentrations exceeding design live loading (25 lbs per sq. ft.)

1.06 PROJECT CONDITIONS

- A. Perform construction operations to minimize inconvenience to the Authority's operations. The Authority will recommend the locations where the materials and equipment may be stored.
- B. Any damage to existing facilities must be repaired at no cost to the Authority by the Contractor and to the Authority's satisfaction.
- C. Environmental Requirements
 - 1. Proceed with roofing system installation only when existing and forecasted weather conditions are favorable and will allow work to proceed in accordance with requirements and specifications of manufacturers roofing system materials.
 - 2. Coordinate work in such a way that no roofing work is done when temperature is below 45 degrees F. In the event that minor remaining roofing work must be done below 45 degrees F but above 36 degrees F, following conditions shall be met:
 - a. Keep felts in a heated area, approximately 70 degrees F.
 - b. Maintain at recommended application temperature by using insulated carrier or insulated pipes or by other means.
 - c. Do not overheat bitumen.
 - d. Mop close to the roll and broom immediately.

1.07 WARRANTY

- A. Prior to acceptance of work, furnish manufacturer's standard written warranty which covers repairs required to maintain roof in watertight condition including:
 - 1. Premature deterioration of membrane.
 - 2. Premature deterioration of base flashing.
 - 3. Premature deterioration of the roof insulation, recover board, cants, curbs or blocking.
 - 4. Bare spots.
 - 5. Blisters.
 - 6. Fishmouths.
 - 7. Ridges.
 - 8. Splits.
 - 9. Buckles and wrinkles.
 - 10. Workmanship in application of roofing membrane.
 - 11. Workmanship in application of base flashings.
 - 12. Workmanship in application of insulation, recover board, cants, curbs or blocking.
 - 13. Slippage of roofing membrane.

14. Slippage of base flashing.
 15. Leaks.
 16. Delamination of the insulation, recover board, felts or flashing.
 17. Improper installation of the system or any component of the system.
- B. Warranty from the manufacturer of roofing system materials shall be for twenty-five (25) years after final acceptance.
- C. The warranty shall require the manufacturer to provide for repairs or replacements, including all materials and labor, for failure of any materials or workmanship of the roof system at no expense to the Authority during the entire warranty period (No Dollar Limit).
- D. Warranty shall be signed by the manufacturer of the roofing materials and include all components of the system including insulation and flashing. Warranty shall certify that the manufacturer's representative has inspected the installation of the roofing system and determines that it is complete, proper and as specified. The warranty shall fully cover all materials and installation of the roof system.

1.08 EXISTING CONDITIONS.

- A. Contractor to inspect and verify all existing conditions and dimensions of the actual site and roof, including conditions under which he will be performing the work at this location, and include in his price all costs to complete the work properly. No extras for failure to inspect the work will be allowed.

PART 2 PRODUCTS

2.01 ROOFING SYSTEM

- A. Roof: Four (4) total layers consisting of three (3) Ply fiberglass type IV felts roofing capped with an additional top ply of SBS type, granular surfaced modified bitumen membrane. Flashing: Three (3) total layers of base flashing consisting of two (2) ply of type IV felts and topped with one (1) ply modified bitumen base sheet.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
1. Johns Manville: Specs No. 4CID
 2. Plies of (GlasPly VI) fiberglass felts:
1-ply DynaKap CR FR, granular surfaced
Base Flashing:
1-ply Dynaflex CR CF over two plies of (GlasPlyIV) fiberglass felts.
 3. GAF: Specs No.I-3-1-MGP
3-ply of (Ply VI) fiberglass felts
1-ply Ruberoid Energy Cap SBS 30 FR, granular surfaced. Base flashing:
1-ply Ruberoid Energy Cap SBS 30 FR, over 2 plies of Ply VI fiberglass felts.

2.02 MATERIALS

- A. Felts: ASTM D 2178-76, Type VI, asphalt-impregnated, glass-fiber felts.
- B. Asphalt: ASTM D 312, Type III and Type IV following information shall be printed on the labels of asphalt rolls or bills.
1. Softening point, minimum flashpoint, minimum blowing temperature and equiviscous temperature.

- C. Modified Bitumen Membranes: ASTM D 6164, Grade G, Type I or II, polyester-reinforced, or ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced or ASTM D 6162, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced, SBS-modified asphalt sheet; white granular surfaced and coated in the factory to meet City of Chicago Energy Code.
- D. Flashing Sheet: ASTM D 6164, Grade G, Type I or II, polyester-reinforced, or ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced or ASTM D 6162, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced, SBS-modified asphalt sheet; white granular surfaced.
- E. Primer: ASTM D 41
- F. Asphalt Roofing Cement: ASTM D 2822, Type II or III or ASTM D 4586 Type II or III.
- G. Polyisocyanurate Board Insulation: ASTM C 1289, Type II. Rigid foam boards with minimum density of 1.7 pcf polyisocyanurate-based foam core, permanently bonded to roofing felt facer sheets both sides; minimum aged R value of 5.88, when conditioned according to TIMA Bulletin No. 101-1 (TIMA 281-1). Provide factory-tapered insulation boards where indicated or required for slope; provide minimum $\frac{1}{4}$ " per foot slope to drains.
 - 1. Manufacturers:
 - a. AlliedSignal Inc.; Commercial Roofing Systems.
 - b. Apache Products Company.
 - c. Atlas Roofing Corporation.
 - d. Carlisle SynTec Incorporated.
 - e. Celotex Corporation.
 - f. Firestone Building Products Company.
 - g. GAF Materials Corporation.
 - h. GenFlex Roofing Systems.
 - i. Hunter Panels, LLC.
 - j. Johns Manville International. Inc.
 - k. Koppers Industries.
 - l. RMAX.
 - m. Approved equal.
- H. Cants: Same material as insulation unless otherwise noted.
- I. Roof Curbs: Provide galvanized metal roof curbs capable of supporting live loads and dead loads including equipment loads. Fabricate with welded or sealed corners and integral formed mounting flange at perimeter. Coordinate dimensions with shop drawings for size of opening, size of equipment, mounting conditions at roof, and mounting conditions of equipment.
 - 1. Factory insulate curbs with 1 $\frac{1}{2}$ " thick Polyisocyanurate Board Insulation with treated wood nailers at tops of curbs.
 - 2. Minimum height of curb to be 12" unless otherwise indicated.
- J. Perlite Board Insulation: Rigid, mineral-aggregate thermal insulation board consisting of expanded perlite, cellulosic fiber, binders and water-proofing agents with top surface seal coated, complying with ASTM C 728. Aged R-Value of 2.78 R per inch. Thickness $\frac{3}{4}$ " or 1" as indicated.
- K. Underlayment/Recover Board: Mechanically fastened, siliconized gypsum, fire tested hardboard suitable to receive adhesive applied membrane.

1. U.L. Class A listed, non-combustible, ASTM E-136, FM Class 1, FMRC 90psf uplift approved, moisture resistant, Zero Flame Spread and Zero Smoke Developed.
 2. Water absorption of underlayment/recover board to not exceed 10% maximum, surface water absorption to be 2.5 grams, compressive strength to be 500-900 psi.
 3. Thickness: ½" unless noted otherwise.
 4. Product: Subject to compliance with requirements, provide underlayment/recover board by the following:
 - a. Georgia-Pacific Corporation ("Dens-Deck").
 - b. Approved Equal.
- L. Fasteners: Fasteners and plates to be stainless steel or galvanized metal. Fasteners to be designed and of proper length to mechanically fasten new recover board and/or insulation boards through to existing metal deck. Fasteners and accessories to be acceptable and approved by recover board, insulation board and membrane manufacturers. Provide either 1 inch diameter nail heads or 1 3/8" diameter by 0.012 inch metal caps for nails, stainless steel or galvanized metal, used to mechanically fasten recover and insulation boards. Use 3 inch diameter plates.
- M. Termination bar: 0.1875 inches thick, 1.75 inches long extruded aluminum bar. 0.375 inches long section at each end is bent at 45 degrees. Pre-punched, elongated holes @ 6 inches on center to receive .25 inches diameter anchor bolts. New Era "CB-175" or equal.
- N. WalkwayPads: Preformed, skid-resistant boards consisting of modified asphalt, reinforcements and fillers with a ceramic granular surface on both sides; produced by same manufacturer as Modified Bituminous Sheet Roofing, such as Dyna Tred Plus as manufactured by Johns Manville or approved equal. Walkway boards to be approximately 32" x 32" x 3/8" thick. Color to be white.

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

- A. Before starting roof work, conduct conference at the project site. Comply with requirements for pre-installation conferences in other Division 01 Sections of these Specifications. Review methods and procedures related to existing conditions and proposed roofing system including, but not limited to, the following:
 - 1. Meet with owner's representative, roofing system manufacturer(s), roofing system installer(s) and other involved parties.
 - 2. Review methods and procedures related to roofing system installation.
 - 3. Review and finalize construction schedule.
 - 4. Review special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
- B. Examine substrate surface to receive roofing system and associated work and conditions under which roofing will be installed. Prepare substrate as recommended and directed by the installer. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Installer is responsible for acceptance of the substrate.
- C. Applicator shall verify that roof curbs, nailers, cants, equipment supports, vents, roof drains and other roof penetrations are properly secured and prepared to receive new roofing materials.
- D. Applicator shall verify that all surfaces are smooth and free of dirt, debris, and incompatible materials. All substrate surfaces shall be free of water, ice, and snow.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install roofing system strictly according to manufacturer's instructions and to comply with all governing codes and regulations.

3.03 PREPARATION OF ROOF

- A. Clean roof deck to provide a smooth and clean substrate.
- B. Prime roof deck as recommended by manufacturer of insulation, using recommended materials.
- C. Protect roof drains and adjacent surfaces.

3.04 ROOF ACCESSORIES

- A. Prior to installation, verify conditions and dimensions in the field for installation of cants and curbs. Verify that substrate is sound, dry, smooth, and clean.
- B. Install roof accessories including cants, curbs, nailers and blocking according to manufacturer's instructions. Anchor roof accessories securely in place and capable of resisting specified forces, using approved fasteners. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- C. Install cants, curbs, nailers and blocking where shown or required; firmly anchored in place with sufficient number of anchors to resist a minimum force of 300 pounds per lineal foot in any direction. Wood items at the roof shall be treated and shall be free of rot, excess moisture or deterioration.

- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, or buckling.

3.05 INSTALLATION OF POLYISOCYANURATE BOARD INSULATION

- A. Over the clean and dry deck, install new polyisocyanurate insulation boards with long joints continuous. Lay with edges in moderate contact but do not force into place. The thickness of the insulation boards shall be 1 ½" except provide factory-tapered insulation boards fabricated to slope at ¼ inch per 12 inches to roof drains, unless otherwise indicated. Provide saddles as shown or required.
- B. Use insulation to create required roof slope. Where multi-layer installation is required and at saddles, stagger joints with second layer covering joints of previous layer. At drain areas, new insulation to be omitted (approximately 2 sq. ft. area) to facilitate better drainage.
- C. Cut insulation boards to fit neatly to perimeter blocking and around projections through roof. Trim surface of boards where necessary at roof drains so completed surface is flush with drain ring.
- D. For metal decks, secure insulation boards to metal deck using approved mechanical fasteners specifically designed and sized for attaching specified board(s) to metal deck. Fasten insulation board over entire area of roofing with fasteners spaced as required by FM I-90 requirements. Run long joints for board in continuous straight lines, perpendicular to roof slope with end joints staggered between rows. Subsequent layers of insulation shall be secured through the first layer of insulation and into the metal roof deck.

3.06 INSTALLATION OF PERLITE INSULATION

- A. Where indicated, install perlite board insulation. If installed over the polyisocyanurate insulation, cover joints between the polyisocyanurate boards with the recover boards. Lay with edges in moderate contact but do not force into place. The thickness of the perlite shall be ½" to 1" (as indicated) except at roof drain locations an area of approximately 3' by 3' shall be ¼" thick to provide proper slope.
- B. Secure perlite to deck using approved mechanical fasteners specifically designed and sized for attaching specified board through any additional insulation and secure to the metal deck. Field verify fastener sizes and required lengths. Fasten perlite board over entire area of roofing with fasteners spaced as required by FM I-90 requirements. Perlite can also be secured in type III hot asphalt at a rate of 30 pounds per 100 square feet. Run long joints for board in continuous straight lines, perpendicular to roof slope with end joints staggered between rows.
- C. Cut perlite board to fit neatly to perimeter blocking and around projections through roof. Trim surface of board where necessary at roof drains so completed surface is flush with drain ring. Adhere perlite saddles, ½ inch slope, with type III asphalt between drains.

3.07 INSTALLATION OF RECOVER BOARD

- A. Where indicated, install recover boards over the polyisocyanurate insulation. Cover joints between the polyisocyanurate insulation with recover boards. Lay with edges in moderate contact but do not force into place. The thickness of the recover board shall be ½" except at roof drain locations an area of approximately 3' by 3' shall be 1/4" thick to provide proper slope.
- B. Secure recover board to deck using approved mechanical fasteners specifically designed and sized for attaching specified board through any additional insulation and secure to the metal deck. Field verify fastener sizes and required lengths. Fasten recover board over entire area of roofing with fasteners spaced as required by FM I-90 requirements. Recover board can also be secured in type III hot asphalt at a rate of 30 pounds per 100 square feet. Run long joints for board in continuous straight lines, perpendicular to roof slope with end joints staggered between rows.
- C. Cut recover board to fit neatly to perimeter blocking and around projections through roof. Trim surface of board where necessary at roof drains so completed surface is flush with drain ring. Adhere recover board saddles, ½ inch slope, with type III asphalt between drains.

3.08 BUILT-UP MODIFIED BITUMEN ROOF

- A. Install in accordance with accepted roofing manufacturer's specification in shingle fashion and as specified below:
 - 1. Apply hot type III asphalt in the roofing system within 25 degrees F of the EVT temperature.
 - 2. Do not heat asphalt to the minimum flash point.
 - 3. Do not hold asphalt beyond the blowing temperature more than four (4) hours.
 - 4. Provide thermostatic controls and visible thermometer on kettle and maintain in working order and keep calibrated.
 - a. Minimum rate application:
 - 1) Between layers: 23 to 25 lbs. Per 100 sq. ft. as specified by roofing manufacturer.
- B. Mopping:
 - 1. Solid mop heated asphalt under and between felts.
 - 2. Provide complete uniform coating. Felt shall not touch felts.
 - 3. Lay felts parallel to long dimension of roof.
 - 4. Broom or press felts into heated asphalt providing tight, smooth laminations without wrinkles, buckles, kinks or fishmouths.
 - 5. At modified bitumen, the roll must push a puddle of asphalt in front such that asphalt is running out both sides of the sheet about 1/2".
 - 6. Maximum brooming in distance behind felt laying: 6 feet.
 - 7. Complete application of roofing system without defects.
- C. Roofing:
 - 1. Install three (3) plies of Type IV felts and one (1) top ply SBS type modified bitumen with granular surface applied in Type III hot asphalt.

3.09 BASE FLASHING

- A. Prepare surfaces to receive new flashings. Remove any materials such as dried asphalt particles or protruding mortar particles that will affect the proper installation of new flashing.
- B. Prime the surfaces if required, and let them dry.
- C. Install two (2) plies of Type IV fiberglass felts using Type IV asphalt. Press against the surfaces for a smooth wrinkle free membrane and adhere at all areas.
- D. Over this apply one (1) ply granular surfaced SBS type modified bitumen base flashing using IV asphalt. The entire installation shall be smooth, wrinkle free and adhered to base and roof surfaces at all areas.
- E. The height of base flashing shall be about 9" high at the lowest point of flashing.

3.10 ROOF DRAINS

- A. Protect roof drain openings during the course of the work. Inspect and clean roof drainage systems. Rod out if required upon completion of the work. Install new roof drains including receptors, strainers, clamping ring, deck clamp and other components of the roof drain. Provide and install new four (4) pound lead flashing at roof drains and strip-in with one ply of membrane.

3.11 WALKWAY BOARDS

- A. Walkway Board Installation: Layout as shown on roof plan or as directed and approved otherwise. Install as directed by manufacturer. Over mineral-surfaced roofs, install walkway board in either a full bed of hot asphalt or MBR Utility Cement. If installed in hot asphalt, use the same asphalt recommended for use with the BUR or modified bitumen membrane. All four corners of each piece should be firmly and fully set prior to walking on the board.
- B. Leave a minimum of 1" open space in all directions between walkway boards to provide for drainage of the roofing system.

3.12 JOINTS

- A. Caulk and seal all joints.

3.13 TEMPORARY COVER

- A. Schedule the work so that there is no need for temporary cover. However if an unforeseen conditions requires a temporary cover:
 - 1. Cover shall be properly installed to protect the deck and installation.
 - 2. Install cover at no cost to the Authority.
 - 3. Remove cover and discard before starting permanent work.

3.14 FIELD TESTS

- A. Contractor shall arrange for and pay for testing of roofing system, including all components, flashing, adhesives and seams; if required by the Authority. Testing shall be performed by an independent testing agency approved by the Authority. Contractor shall patch at any areas of the roof where test samples are taken; patch according to manufacturer's directions to maintain integrity and warrantability of the roofing system.

3.15 CLEANING

- A. Protect paving and building walls adjacent to hoist prior to starting work.
- B. Repair or replace with new any damaged materials and remove asphalt and stains from surfaces other than those requiring bituminous roof coatings.
- C. Remove all trash, debris, equipment and parts from job site. Dispose of waste legally.
- D. All paved areas, landscaped areas, and other exterior and interior areas and surfaces damaged or otherwise affected by roofing activities shall be repaired and restored to its original condition at no cost to the owner. All areas to be cleaned of debris and left broom clean.
- E. All roofing, flashings, scraps, wrappings, empty cans, metal work and other debris to be removed during and after construction and disposed of legally.

3.16 WARRANTY

- A. Upon completion of the roofing system installation, an inspection shall be made by the manufacturer's representative to certify and approve of the installation.
- B. Upon approval of the installation, provide the Authority with the installer's and manufacturer's warranties in the approved form, signed by all installers and manufacturers involved, to warranty all components of the roofing system, their installation, as well as the roofing system as a whole.

3.17 PROTECTION

- A. Provide special protection or avoid traffic on completed work when ambient temperature is above 80 degrees F.
- B. Restore to original condition or replace work or materials damaged during handling bitumens and roofing materials.
- C. Protect paving and building walls adjacent to hoist and kettles prior to starting work. Protect existing roof drains and other existing items from damage during the work. Cover roof drains during the work to keep asphalt, dirt or debris from falling into the drains.
- D. Leave protective covering securely in place for duration of roofing work.

END OF SECTION 07 52 50

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following:

1. Sheet metal roof flashing and trim.
2. Formed wall flashing and trim.
3. Gutters and downspouts.
4. Preformed copings.
5. Fasteners and attachment devices.
6. Coatings and slip sheets to isolate sheet metal from dissimilar materials.
7. Miscellaneous sheet metal accessories.

- B. Sheet metal may be specified as steel, galvanized steel or stainless steel.

- C. The following are specified elsewhere:

1. Translucent Canopy Roof Assembly and related aluminum flashing installed integral with polycarbonate panel system are specified in the Translucent Canopy Roofing Section.

1.03 RELATED WORK

- A. Section 05 50 00, Metal Fabrications.

- B. Section 06 10 00, Rough Carpentry.

- C. Section 07 90 00, Joint Sealants.

1.04 REFERENCES

- A. AAMA 2605B - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

- B. ASTM A167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process, and Lock-Forming Quality.

- D. ASTM A755/A755M - Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

- E. ASTM D4397 - Specifications for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

- F. ASTM E154 - Methods of Testing Materials for Use as Vapor Barriers Under Concrete

Slabs and as Ground Cover in Crawl Spaces.

- G. FM Loss Prevention Data Sheet 1-49: Perimeter Flashing.
- H. FS UU-B-790a - Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent, and Fire Resistant).
- I. FS TT-C-494B - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- J. SMACNA: Architectural Sheet Metal Manual.
- K. NRCA: Roofing and Waterproofing Manual.

1.05 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting forces in accordance with the Chicago Building Code.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degrees Fahrenheit, ambient; 180 degrees Fahrenheit, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.06 SUBMITTALS

- A. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general specifications for each specified sheet material and fabricated product.
- B. Samples of all flashing, sheet metal, and accessory items or fabrications:
 - 1. 8-inch-square or 12 inch long samples of each specified sheet material or product in the type of metal and finish required.
- C. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop-and field-assembled work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, jointing, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - 4. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.07 QUALITY ASSURANCE

- A. Installer: A company specializing with installing products included in this section and which has completed at least twenty (20) installations similar in scope to work included in this section.
- B. Quality Standard:
 - 1. Provide sheet metal work in accordance with Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) "Architectural Sheet Metal Manual," unless specifically indicated otherwise.
- C. Provide sheet metal to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.08 PROJECT CONDITIONS

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
- D. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak proof, secure, and noncorrosive installation.

PART 2 PRODUCTS

2.01 SHEET METAL MATERIALS

- A. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A755, G 90 ASTM A755M, Z 275 coating designation, coil coated with high-performance fluoropolymer coating as specified in "Finishes" Article; not less than 0.0336 inch 0.85 mm thick, unless otherwise indicated.
 - 1. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A653/A653M for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; minimum 0.0359-inch thick (20 gauge) except as otherwise indicated.
- B. Stainless Steel: ASTM A 240/ A 240M or ASTM A 666, Type 304, No. 4 annealed finish, soft, except where harder temper required for forming or performance; minimum 0.0187 inch thick except as otherwise indicated.

2.02 ACCESSORY MATERIALS

- A. Fasteners: Corrosion-resistant metal of same material as the material being fastened or other material recommended by sheet metal manufacturer. Match finish and color of exposed fastener heads to finish and color of sheet material being fastened.
- B. Sealant: As specified in Section 07900 - Joint Sealants.

1. Use concurring type for concealed joints.
 2. Use non-sag elastomeric type for exposed joints.
- C. Joint Adhesive: Two-component noncorrosive epoxy adhesive, recommended by metal manufacturer for sealing of nonmoving joints.
- D. Bituminous Coating: Heavy bodied, sulfur-free, asphalt-based paint; FS TT-C-494.
- E. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.
- F. Polyethylene Underlayment: ASTM D4397, minimum 6-mil thick black polyethylene film, resistant to decay when tested according to ASTM E154.
- G. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; non-corrosive; size and thickness required for performance.
- H. Gutter Screen: 1/4 inch hardware cloth installed in sheet metal frames. Fabricate screen and frame of same basic material as gutters and downspouts.
- I. Drip Edges: Fabricate from the following material:
1. Stainless Steel: 0.016 inch thick.
- J. Base Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.028 inch thick.
- K. Counterflashing: Fabricate from the following material:
1. Galvanized Steel: 0.022 inch thick.
- L. Flashing Receivers: Fabricate from the following material:
1. Stainless Steel: 0.016 inch thick.
- M. Openings Flashing: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch high dams. Fabricate from the following material:
1. Stainless Steel: 0.019 inch thick.

N. Equipment Support Flashing: Fabricate from the following material:

1. Stainless Steel: 0.019 inch thick.

O. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Galvanized Steel: 0.0396 inch thick.

2.03 FINISHES

A. Prefinished Galvanized Steel Sheet:

1. Coil coated "Kynar 500" or "Hylar 5000" resin finish over epoxy primer; minimum system thickness 1.0 mil. Provide manufacturer's standard prime coat on underside.
2. Finish coating to be manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color: Standard color as selected by Commissioner.
3. Provide strippable plastic protective film on prefinished surface.

2.04 FABRICATED UNITS

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and specifications for forming material. Form exposed sheet metal to match profiles indicated without substantially free of oil-canning, fish-mouths, buckling, tool marks, and other defects; true to line and levels indicated. Form a 1/2 inch hem, folded back, on underside of exposed edges.

B. Manufacturers:

1. Atas Aluminum Corporation.
2. Cheney Flashing Company, Inc.
3. Copper Sales, Inc.
4. Fry Reglet Corporation
5. Keystone Flashing Company, Inc.
6. Metal Era, Inc.
7. M&M Systems, Inc.
8. Petersen Aluminum Corporation.
9. Vincent Metals Division/Rio Algom, Inc.
10. W.M. Hickman Co.

C. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges shall be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal work exceeding 15 feet running length. For flashing and trim, provide movement joints at maximum spacing of 10 feet; no joints allowed within 2 feet of corner or intersection. Where lapped or bayonet-type expansion provisions in work cannot be used or would not

be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

- E. Conceal fasteners and expansion provisions wherever possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- F. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Gauge: As recommended by SMACNA or metal manufacturer for application, but in no case less than gage of metal being secured.
- G. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- H. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as specified by manufacturer/fabricator.

2.05 GUTTERS AND DOWNSPOUTS

- A. Fabricate from pre-finished galvanized steel with same type of finish and color as roof panels.
- B. Form sheet metal to profile dimensions indicated, free from distortions and defects detrimental to water-tight system.
 - 1. Seam and seal metal joints except for joints indicated by SMACNA to be welded.
- C. Provide removable debris screens for gutters as indicated, fabricated from frame and 1/4 inch mesh wire cloth of same material used for gutters or approved compatible material. Provide formed sheet metal frame on 4 sides of each screen unit. Length of screen units not to exceed 10 feet.
- D. Provide wire basket type strainers at downspouts as indicated, fabricated from wire and sheet metal of same material used for downspouts or approved compatible material.
- E. Gutter Supports: Straps of same material and finish.
- F. Downspout Supports: Straps of same material and finish.

2.06 PREFORMED COPING SYSTEMS

- A. Coping and gravel stop systems shall be fabricated from sheet metal as indicted on drawings in thickness as recommended by the SMACNA "Architectural Sheet Metal Manual", with allowance for expansion and contraction. Provide manufacturers standard concealed gutter/splice chair at joints and galvanized steel cleats. Front face dimension to be as indicated on the drawings, but 3-1/2 inches minimum.
- B. Provide manufacturer's standard factory formed mitered corners, seams to be fully welded.
- C. Where indicated, provide coping system of type 304 stainless steel with annealed No. 4 finish complying with ASTM A240.

- D. Products:
1. W.M. Hickman Co. - Permasnap
 2. Metal Era - Anchor-tite
 3. Litsco – Stream Line.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which products of this section are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
1. Verify that nailers, blocking, and other attachment provisions for sheet metal work are properly located and securely fastened to resist effects of wind and thermal stresses.

3.02 PREPARATION

- A. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- B. Isolate dissimilar metals by means of a heavy bituminous coating, approved paint coating, adhered polyethylene sheet, or other means approved by the engineer.

3.03 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and specifications and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work to fit substrates and with laps, joints, and seams that will be permanently watertight and weatherproof.
1. Torch cutting of sheet metal flashing and trim is not formulated.
- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks. Fold back exposed edges to form hems. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Secure metal flashings and other items as recommended by manufacturer and as required for wind as indicated in the "Performance Requirements" Article of this specification.
- D. Solder joints unless noted otherwise; except do not solder aluminum or coil-coated galvanized steel sheet.
- E. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- F. Sealed Joints: Form minimum 1-inch hooked joints and embed flange into sealant or adhesive. Form metal to completely conceal sealant or adhesive.
1. Use joint adhesive for nonmoving joints specified not to be soldered.
 2. Moving joints: When ambient temperature is moderate (40-70 degrees Fahrenheit) at time of installation, set joined members for 50 percent movement

either way. Adjust setting position of joined members proportionally for temperatures above 70 degrees Fahrenheit. Do not install sealant at temperatures below 40 degrees Fahrenheit. Refer to section on sealants elsewhere in Division 7 for handling and installation requirements for joint sealers.

- G. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items with roofing installation. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.
- H. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- I. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- J. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24-inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- K. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 - 2. Stainless Steel: Use stainless-steel fasteners.
- L. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.

3.04 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Built-in Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with butyl sealant. Provide for thermal expansion. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Install felt underlayment layer in built-in trough and extend to drip edge at eave. Lap edges a minimum of 4 inches.
 - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 - 3. Anchor and loosely lock back edge of gutter to continuous cleat, eave or apron flashing.
 - 4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 - 5. Install gutter with expansion joints at locations indicated but not exceeding 50

- feet apart. Install expansion joint caps.
6. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

- C. Downspouts: As specified in Section 05500—Metal Fabrications.
- D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.05 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch and 16-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 24-inch and 18-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
1. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.
- F. Roof-Penetrating Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.06 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as doors and louvers.

3.07 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety and Interior Drip Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.08 CLEANING AND PROTECTION

- A. Remove protective film from prefinished sheet metal immediately after installation.
- B. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- C. Repair or replace work which is damaged or defaced, as directed by the Engineer.
 - 1. Refinish marred and abraded areas of prefinished sheet using finish manufacturer's recommended methods and materials. Replace units, which in the opinion of the Engineer, cannot satisfactorily be refinished in place.
- D. Protect sheet metal work as recommended by the installer so that completed work will be clean, secured, and without damage at substantial completion.

END OF SECTION 07 60 00

SECTION 07 70 00
ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Drawings and other specification sections apply to this section.
- B. Furnish and install Roof Specialties and Accessories as shown on the Drawings and as specified herein, including but not limited to the following:
 - 1. Roof Hatch.
- C. Install products and materials (furnished in other Sections) as shown on the Drawings and as specified herein, including but not limited to the following:
 - 1. Sealants.

1.02 RELATED WORK:

- A. As specified in the following divisions:
 - 1. Division 5 – Metals
 - 2. Division 7 – Thermal and Moisture Protection

1.03 REFERENCES:

- A. FM - Roof Assembly Classifications.
- B. UL - Fire Hazard Classifications.

1.04 SUBMITTALS:

- A. Submit the following
 - 1. Shop Drawings
 - a. Roof Hatch Details.
 - b. Manufacturer's Installation Instructions - Indicate special installation criteria, interface with adjacent components.
 - 2. Samples and/or Product Data
 - a. Product Data:
 - 1) Provide data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.
 - 3. Manufacturer's Certification
 - a. Certify that products meet or exceed the specified requirements.

1.05 QUALITY CONTROL:

- A. Contractor Qualifications - Installation of roof specialties and accessories must be

performed only by a qualified installer. The term qualified means experienced in performing the Work required by this Section. The qualified installer must have a minimum of five (5) years documented experience on Projects similar in size and scope to this Project. The installer must submit evidence of such qualifications upon request by the Commissioner.

- B. Perform Work in accordance with the latest edition, of the appropriate divisions, of the following:
 - 1. Shop drawing and
 - 2. Manufacturer's printed instructions.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Materials must be delivered to the Project bearing Manufacturer's name and material identification. Materials must be stored in strict accordance with the Manufacturer's printed directions, copies of which must be furnished to the Commissioner.
- B. Protect materials against damage from mechanical abuse, plaster, salts, acids, staining and other foreign matter by an approved means during transportation, storage and erection and until completion of construction work. All unsatisfactory materials must be removed from the premises, and all damaged materials replaced with new materials.

1.07 WARRANTIES AND GUARANTEES:

- A. The following materials have special Manufacturer's Warranties for the periods listed with each item, which may originate, in part or in whole, with the manufacturer or the fabricator and such warranties must be passed through the Contractor to the Department.
 - 1. Roof Hatch.
- B. The Contractor must repair or replace defective materials and workmanship during the Contract Period and for five (5) years from the date of Substantial Completion of the Project. Defective material and workmanship include, but are not limited to, the following:
 - 1. Warranty will include coverage for installed accessories which fail to achieve water tight seal.

1.08 SPECIAL REQUIREMENTS:

- A. Field Measurements - Before proceeding with the fabrication of the roof access-hatch work, the supplier/installer must verify all dimensions and take such measurements as are required for proper fabrication and installation of the work.
- B. Coordination - Coordinate work of this Section with related Work specified in other divisions/Sections of the Contract Documents.

1.09 REGULATORY REQUIREMENTS:

- A. Conform to applicable code for UL and FM requirements as applicable to roof hatches.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Products of one of the following Manufacturers will be acceptable:
1. Model # S - Bilco Co., New Haven, Connecticut 06505.
 2. Model # 6-102 - Babcock- Davis Hatchways, Inc., Arlington, Massachusetts 02174.

2.02 FABRICATION:

- A. Fabricate components free of visual distortion or defects. Weld corners and joints.
- B. Provide for removal of condensation occurring within components or assembly.
- C. Fit components for weather tight assembly.

2.03 ROOF HATCHES:

- A. Provide and install all roof hatches and related components in size and type shown and specified. Dimensions of roof hatch and clearance for ladder access must comply with OSHA minimum standards.
1. Cover must be 14 galvanized steel formed with 3" beaded flanges welded and ground smooth at the corners. Cover must be insulated with 1" fiber glass board, fully covered and protected by a 22 gauge (minimum) galvanized steel liner.
 2. Curb must be 14 gauge galvanized steel formed with a 3-1/2" flange provided with holes for securing to the roof curb. Curb must be complete with integral cap flashing of same material, fully welded and ground at corners for absolute water tightness. Side of curb must be insulated as noted above and protected by a 22 gauge (minimum) galvanized steel liner. Curbs must be of a minimum height shown, above top of steel angle closure. Curbs must be reinforced as required.
 3. Roof hatches must be completely assembled with heavy pliable hinges, two automatic hold open reverse action lifting levers, positive snap locks with turn handles on inside and outside, and an extruded neoprene rubber draft seal. Provision must be made to receive padlock on both inside and outside.
 4. Spring lifting levers must be installed to lift cover with a minimum of effort and hold cover in open position until manually pulled down.
 5. Installation of roof hatches must be made over prepared roof openings by anchoring curb flanges securely to roof deck and through anchor bolted to supporting steel roof deck, ready to receive base flashing at finish roof level, for a completely water-tight installation.
- B. Ladder Post
1. At each roof scuttle, install on fixed ladder below hatch cover a "Ladder Up" Post as manufactured by: Bilco Company.
 2. Device must be fabricated of high strength steel, hot dipped galvanized, with telescoping tubular section which locks automatically when fully extended. Upward and downward movement must be controlled by a special alloy spring balancing mechanism. Finish must be black enamel.
 3. Unit must be completely assembled with fasteners for securing to the ladder rungs in accordance with the Manufacturer's instructions.

PART 3 EXECUTION

3.01 INSPECTION:

- A. Before commencing installation, examine substrate surfaces to determine that they are free of conditions which might be detrimental to proper and timely completion of the Work. Start of Work must indicate acceptance of the substrate.

3.02 INSTALLATION:

- A. Installation of roof hatches must be made in strict accordance with manufacturer's printed installation instructions.
- B. Coordinate with installation of roofing system and related flashings for weather tight installation.
- C. Apply bituminous paint on surfaces of units in contact with cementitious materials or dissimilar metals.
- D. Adjust hinges for smooth operation.

3.03 GENERAL CLEAN-UP:

- A. All rubbish and debris resulting from the Work of this Section must be collected, removed from the site and disposed of legally.
- B. All work areas must be left in a clean condition.

END OF SECTION 07 70 00

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

- A. General: Provide Firestopping in accordance with requirements of the Contract Documents.
- B. Work Included: Firestopping applications include, but are not necessarily limited to, the following.
 - 1. Openings in fire-rated floors and walls, both empty openings and openings containing penetrations such as conduits, cables, wires, pipes, ducts, and similar penetrating items.
 - 2. Perimeter joints at juncture of fire-rated concrete, floors and at juncture of fire-rated openings in floor wall or roofing.
 - 3. Construction joints in fire-rated concrete floors.

1.02 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.03 DEFINITIONS

- A. Fire-Rated Walls and Floors: The term "fire-rated walls" as used in this Section refers to fire-resistance rated assemblies including walls and partitions. The term "fire-rated floors" as used in this Section refers to fire-resistance rated assemblies including floor/ceiling and floor/roof.
- B. F-Ratings: The term "F-ratings" indicate that the firestop system withstood the fire test for the rating period without the following taking place: flames passing through openings, flaming of any element on the unexposed side of the firestop system, and any openings developing that permit water from the hose stream to project beyond the unexposed side.
- C. T-Ratings: The term "T-ratings" signify that heat transmitted through the firestop system during the rating period did not raise the temperature of any thermocouple on the unexposed firestop system surface or on any penetrating item by more than 325 degrees Fahrenheit above its initial temperature.

1.04 REFERENCES

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

1.05 SYSTEM DESCRIPTION

- A. Performance, General: Provide firestopping materials and systems produced, tested, and installed to resist the spread of fire and the passage of smoke and gases, in accordance with the requirements indicated.
- B. Testing and Ratings: Except as otherwise specified, provide firestopping materials and systems which have been tested, rated, and listed by UL or other testing agency acceptable to authorities having jurisdiction, as an assembly for the type and configuration of firestopping and surrounding and penetrating construction applicable to each firestopping application.
 - 1. Through-Penetrations: Through-penetration firestopping assembly shall be tested and ratings determined in accordance with ASTM E814 or UL 1479, and as specified.
 - 2. Joints: Firestopping for joints shall be tested and ratings determined in accordance with UL 2079, and as specified. Fire rating shall be time duration the same as or greater than the fire-resistive rating of the surrounding construction.
 - 3. Pressure Differential: Testing of firestops shall include a positive pressure differential of not less than 0.01 inch water column.
 - 4. F-Rating, Through-Penetration Firestops: Through-penetration firestops shall have an F-rating the same or greater time duration as the fire-resistive rating of the surrounding construction being penetrated, but not less than 1-hour.
 - 5. T-Rating, Through-Penetration Firestops: In addition to F-ratings, through-penetration firestops shall have a T-rating the same duration as the required R-rating for the firestop but not less than 1-hour. Firestops required to have T-rating include the following.
 - a. Required in fire-rated floors, except not required where the floor penetration is concealed within a wall cavity at the penetration.
- C. Surface Burning Characteristics: Firestopping materials shall have flame spread and smoke developed ratings not to exceed 25 and 450 respectively when tested in accordance with ASTM E84.
- D. Air Seal: In addition to firestopping preventing passage of smoke and gases during and after fire and heat conditions for which they have been tested, the firestopping shall be an effective air seal to prevent passage of smoke and gases in normal service before exposure to heat and fire. Do not use materials intended to function as air seals which are known to shrink with curing or aging.
- E. Compatibility: Provide firestopping materials used in each application which are compatible with each other and with the penetrating and surrounding construction they contact.
- F. Loads: Firestops are not intended to support live loads or traffic.
- G. Moisture Resistance: Firestopping used in the following locations shall be watertight as well as resistant to degradation from moisture during normal service before exposure to heat and fire.
 - 1. Floors of mechanical, electrical, Janitor's rooms or closets and toilet rooms, and walls in such spaces where any portion of the firestopping is 3 inches or less from the floor surface.
 - 2. Exterior walls and roofs.
 - 3. Plumbing systems.

- H. Coordination with Insulation Coverings: Provide firestopping, which does not require the removal of insulation coverings integral to the penetrating item. Insulation coverings include thermal and acoustical insulations and their protective jackets and coverings and insulation/coverings for electrified components.
- I. Content: Firestopping materials shall not contain asbestos fibers or dust particles, nor other substance prohibited by law.
- J. Uniformity: Provide firestopping of the same materials and manufacturer for each type of opening and penetration throughout the Project.

1.06 SUBMITTALS

- A. Shop Drawings: Furnish shop drawings for the fabrication and installation of the Work. Include the following.
 - 1. Indicate specific assembly of firestopping materials, penetrants, size and configuration of penetration or void, thicknesses and securement of materials, and surrounding construction for each firestopping condition and rating. Indicate function of penetrant as well as material and size. List the fire resistance rating of the surrounding building construction and the firestopping "F" and "T" ratings required for the Project for the specific application.
 - 2. Include legend indicating location of each firestopping assembly in the building.
 - 3. Identify each specific assembly with a "type designation" specific to the Project and include in location legend. Indicate corresponding testing agency design assembly number identification with year of test.
 - 4. Identify materials or conditions of the assembly which deviate from the requirements of the corresponding testing agency's assembly.
- B. Supplementary Product Literature: Furnish manufacturer's literature describing the general properties of each product to be used in the Work.
- C. Certifications: Furnish the following.
 - 1. Assembly Test Reports: Certified test reports from the testing agency performing the firestopping test assembly consisting of conclusions and summary to show compliance with requirements and including the corresponding testing agency's design assembly number identification.
 - 2. Engineered Deviations: Certification from manufacturer stating which firestopping assemblies deviate from requirements of the corresponding testing agency's assembly and stating that the proposed deviations have been approved by manufacturer's fire protection engineer.
- D. Statement of Manufacturer's Review: Furnish statement in form stipulated by Authority, signed by the Contractor and Installer, stating that the Drawings and Specifications, the shop drawings and product data have been reviewed with qualified representatives of the materials manufacturers, and that they are in agreement that the selected materials and systems are proper and adequate for the application shown including compatibility with adjacent systems and materials.
- E. Statement of Application: Furnish statement in form stipulated by Authority, signed by the Contractor and Installer, stating that the Work was provided in compliance with the Contract Documents and that the installation was proper for the conditions of application and use.
- F. Record Drawings: Furnish record drawings annotated with the changes made during installation of the Work so as to be a complete set of "as installed" plans. Use shop

drawings as basis to show changes. Accurately depict the entire firestopping assembly and surrounding construction.

1.07 QUALITY ASSURANCE

- A. Contractor's Quality Assurance Responsibilities: Contractor is solely responsible for quality control of the Work.
- B. Manufacturer: Do not use firestopping material produced by manufacturer who will not agree to send a qualified technical representative to the project site, when requested, for the purpose of rendering advice concerning the proper installation of materials.
- C. Licensed Installer: The Installer shall be trained and licensed by the firestopping manufacturer in the use of the materials and equipment to be employed in the Work.
- D. Field Samples: Prior to the Pre-Construction Conference, provide a field sample for each type, condition, and application of firestopping in the building at final installation locations. Utilize the same materials and installation methods in the sample as required for the final Work. Schedule the installation with allowance for sufficient curing time so that the sample may be examined, and any necessary adjustments made, at least 1 week prior to date scheduled for commencing installation of the Work. When accepted, sample areas shall serve as the standard for materials, workmanship, and appearance for such Work throughout the project and shall remain a part of the final Work.
- E. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.

1.09 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Do not proceed with the Work when environmental conditions exceed the limits and conditions recommended by the manufacturer, unless the Work will proceed in accordance with the Manufacturer's requirements and instructions and any agreements or restrictions of the Pre-Construction Conference. Provide and maintain adequate ventilation and environmental conditions for curing and to ensure that completed firestopping is not detrimentally affected by environmental conditions.

1.10 WARRANTY

- A. Firestopping Warranty: Furnish 2 year written warranty in form stipulated by IDOT, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of IDOT.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Silicone Foam: Two-component, elastomeric silicone foam, expanding during cure.
- B. Silicone Sealant: Single-component, elastomeric silicone sealant. ASTM C920, Type S, Grade NS or SL, Class 25.
- C. Intumescent Putty: Prepackaged, moldable, non-hardening putty.
- D. Mortar: Portland cement based non-shrinking mortar, prepackaged dry mix formulated for mixing with water.
- E. Intumescent Caulk: Single-component, water-based latex formulation. Cured material not emulsifiable in water.
- F. Intumescent Collar Devices: Metal collar sleeves encapsulating factory installed intumescent material, except field installed intumescent when standard with manufacturer.
- G. Intumescent Wrap Strips: Flexible intumescent strip material with foil on one side.
- H. Auxiliary Materials: Provide miscellaneous and accessory materials necessary to complete each firestopping condition and system and to obtain the required fire ratings and other performance requirements. Provide materials including, but not limited to, temporary and permanent damming, backing and forming materials, fillers, mechanical fastening and support devices, collars, sleeves, cleaners and primers. Provide materials as recommended and manufactured by firestopping material manufacturer, or if not normally available from firestopping manufacturer, then provide products from sources approved by firestopping manufacturer. Materials shall comply with the tested and rated firestopping system.
- I. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.
 - 1. Do not apply firestopping material until penetrants have been installed through openings in a complete and permanent condition and surrounding construction defining the openings has been completed.

3.02 PREPARATION

- A. Surface Preparation: Provide surface preparation to promote adequate adhesion of firestopping materials and to ensure their compatibility with surfaces and materials with which they contact. Clean substrates to remove coatings or other substances, which might interfere with bond of firestopping materials. Remove materials and substances from openings which are not part of the laboratory tested assembly, unless manufacturer

otherwise recommends. Perform cleaning and surface preparation immediately prior to installation of materials.

3.03 INSTALLATION

- A. General: Comply with manufacturer's directions and final shop drawings. Where field conditions deviate from tested assembly conditions and are not otherwise reflected on shop drawings and certified by manufacturer as an approved engineered deviation, consult with manufacturer's technical representative to determine proper materials and procedures. Do not install materials or provide assemblies not complying with requirements of tested assemblies unless manufacturer certifies that such deviations have been approved by manufacturer's fire protection engineer. Apply materials to obtain complete filling to the correct depths and dimensions without gaps or voids. Use masking tapes or other precautions to prevent spillage or migration of firestopping material onto adjoining surfaces not intended to receive material. Remove excess material except where overlapping onto adjoining construction is normal part of the tested and recommended assembly.
- B. Priming: Prime or seal substrates if necessary to promote proper adhesion in accordance with the manufacturer's recommendations for each application. Avoid migration of primer or surface scaler onto adjoining surfaces and remove any spillage promptly.
- C. Damming: Provide leakproof damming and containment materials to seal openings and contain the placement of firestopping materials that would otherwise flow out of or be displaced from the spaces to be filled.
 - 1. Combustible Type: Use for temporary dams only. Remove after firestopping material has cured and is capable of supporting itself.
 - 2. Noncombustible Type: Use for temporary or permanent dams. Provide for applications where the dam material cannot be removed after application of firestopping.
- D. Bundled and Touching Penetrants: Where penetrants are normally bundled together and where individual penetrants are installed through the same opening, sufficiently separate each penetrant component so as not to be in contact with another penetrant component at its point of passing through the opening to be firestopped, thus allowing firestopping material to completely encapsulate each individual penetrant component resulting in a smoketight and airtight installation.
- E. Void Filler: Provide to seal gaps in noncombustible type damming materials and to seal around penetrants where the void filler is an integral part of the firestopping assembly.
- F. Silicone Foam: Mix and apply in accordance with manufacturer's directions. Factory prepared cartridge may be used for small opening or volumes. Use manufacturer approved automatic metering, mixing and dispensing equipment for large volume applications. Maintain optimum color range and cell structure of cured foam as defined by manufacturer's standards and pictorial guides.
- G. Sealants and Caulks: Provide neat appearance with uniform depth and full contact with substrate surfaces. Tool surface of freshly installed material unless self-leveling product is used.
- H. Putty: Pack putty into voids beginning at back of the opening to be filled and working up to the front of the void. Exert pressure during packing to ensure complete contact with substrates and no voids or unbonded seams within the completed putty application. Provide neat and uniform exposed surface.

1. Mortar: Pump, pour, or trowel mortar into place. Mix with only enough water to produce the necessary consistency for method of placement as recommended by manufacturer. Provide smooth exposed surface.
- I. Collar Devices: Provide factory fabricated devices consisting of metal restraining collar encapsulating intumescent material, except where manufacturer's system combines a field installed calk or wrap strip to be used with a restraining collar. Mechanically fasten the restraining collar. Combine and supplement device with calk or sealant to make the installation function as an air seal.
- J. Wrap Strips: Provide the quantity of wrap strip layers and positioning as required by tested design. Combine wrap strips with use of mechanically fastened metal restraining collars when wrap strips are surface positioned outside of the opening. Support wrap strips using wrapped foil tape or wire. Combine and supplement wrap strips with calk or sealant to make the installation function as an air seal.
- K. Construction Joint Applications: Coordinate placement of firestopping materials with surrounding building construction and supports. Use sealants and caulks to make the assembly joint airtight and to make airtight those joints immediately surrounding the assembly which may otherwise circumvent the assembly joints.

3.04 APPLICATIONS

- A. General: Select and install firestopping materials for the applicable assemblies as recommended by the manufacturer, complying with specified performance requirements, and in accordance with the following material and use requirements.
- B. Silicone Foam, Silicone Sealant, and Putty: Use for penetrants subject to movement or vibration within the movement accommodating capability of the product.
- C. Mortar: Use for static, non-moving penetrants. Use for empty openings. Where required to be moisture resistant, supplement with other materials if recommended by manufacturer to obtain moisture resistance.
- D. Intumescent Devices and Wrap Strips: Use for plastic, insulated, and glass pipes. Supplement with other materials to obtain air seal. Where required to be moisture resistant, supplement with other materials to obtain moisture resistance.
- E. Intumescent Caulk: Use for static, non-moving penetrants. Use for plastic, insulated, and glass pipes.
- F. Construction Joints: Use silicone sealant or silicone foam.
- G. Applications at Fire-Rated HVAC Duct Dampers: Do not use intumescent materials in conjunction with fire-rated HVAC duct dampers in a manner that could cause stress and buckling of construction surrounding duct dampers during intumescence of the firestop material thus impairing the operation of the damper.

3.05 IDENTIFICATION

- A. Field Identification, Through-Penetration Firestops: Provide field identification tags attached to through-penetration firestop assemblies to serve as identification with pertinent information for the completed assembly. Information on tag shall include month and year of firestop material installation, name of principal firestop material manufacturer, corresponding testing agency name and tested design assembly number identification, and the words "Rated Through-Penetration Firestop - Do Not Disturb".

1. Tags: Melamine plastic or brass tag plates. Information on plastic shall be engraved and appear in white color to contrast red color tag face. Both sides of plastic tags may be used to include information. Information on brass plate shall be stamped. Brass shall have clear coating to resist oxidation. Attach tag to a penetrant item approximately 12 inches from the face of the firestop floor or wall opening. Use snug compression fitting plastic ties or brass wire to secure tag to penetrant item.

3.06 ADJUSTING

- A. Repair: Repair damaged firestopping or remove and replace if damaged beyond successful repair. Comply with manufacturer's recommendations for repair and replacement.

3.07 CLEANING

- A. Upon completion of the Work, remove unused materials, debris, containers and equipment from the project site.

3.08 PROTECTION

- A. Protect the Work during the construction period so that it will be without any indication of use or damage at the time of acceptance.

END OF SECTION 07 84 00

SECTION 07 90 00
JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes joint sealers for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below.
 - a. Perimeter joints between materials, frames of doors, windows, vents and other items, control and expansion joints.
 - b. Other joints as indicated.
 - c. At hardware items, fixtures, and other protrusions.
 - d. As required for air and water tight joint.
2. Exterior joints in horizontal traffic surfaces, including control, expansion, and isolation joints in precast concrete planks for platforms and cast-in-place concrete. Precast concrete and stone flooring for floors.
3. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - d. Perimeter joints of toilet fixtures.
 - e. Other joints as indicated.
4. Interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Control and expansion joints.

1.03 RELATED WORK

- A. Section 03 30 00, Cast-In-Place Concrete
- B. Section 07 60 00, Flashing and Sheet Metal
- C. Section 08 80 00, Glass Glazing
- D. Section 09 60 00, Stone Flooring

1.04 REFERENCES

- A. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- B. ASTM C1083 – Standard Test Method for Water Absorption of Cellular Elastomeric Gaskets and Sealing Materials.
- C. ASTM C1193 – Standard Guide for Use of Joint Sealants.
- D. ASTM D1623 – Standard Test Method for Tensile And Tensile Adhesion Properties Of Rigid Cellular Plastics.
- E. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- F. ASTM D2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
- G. ASTM D3405 – Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

1.05 SYSTEM PERFORMANCE

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.06 SUBMITTALS

- A. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.
- B. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.
- C. Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.
- D. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Architect and Owner, plus other information specified.
- E. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and specifications for primers and substrate preparation needed to obtain adhesion.
- F. Product test reports for each type of joint sealers indicated, evidencing compliance with requirements specified.
- G. LEED Submittal:
 - 1. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.
- B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
- C. Preconstruction Compatibility and Adhesion Testing:
Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing.
1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates. Perform tests under normal environmental conditions that will exist during actual installation.
 2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analysis of results to prevent delay in the work progress.
 4. Investigate materials failing compatibility or adhesion tests and obtain joint sealer manufacturer's written specifications for corrective measures, including use of specially formulated primers.
 5. Testing will not be required when joint sealer manufacturer is able to submit joint preparation data required above which is acceptable to Architect and is based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.
1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
 2. Include test results performed on joint sealers after they have cured 1 year.
- E. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 3. Arrange for tests to take place with joint sealer manufacturer's technical representative present.
 4. Test Method: Test joint sealers by hand pull method described below:
 - a. Install joint sealants in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
 - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of

joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 inch from top of 2 inch piece.

- c. Use fingers to grasp 2 inch piece of sealant just above 1 inch mark; pull firmly down at a 90 degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance specified by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 5. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 6. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants which fail to adhere to joint substrates during testing.
- F. Field-Constructed Mock-Ups: Prior to installation of joint sealers, apply elastomeric sealants to the following selected building joints as indicated below for further verification of colors selected from sample submittals and to represent completed work for qualities of appearance, materials, and application:
1. Joints in field-constructed mock-ups of assemblies specified in other sections which are indicated to receive elastomeric joint sealants specified in this section.
 2. Retain mock-ups during construction as standard for judging completed construction.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturers' specifications to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.09 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 degrees Fahrenheit (4.4 degrees Celsius).
 3. When joint substrates are wet due to rain, frost, condensation, or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealers to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- C. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

2.02 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those referenced for Type, Grade, Class, and Uses.
- B. One-Part Mildew-Resistant Silicone Sealant (Toilet): Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.
- C. One-Part High-Modulus Nonacid-Curing Silicone Sealant: Type S, Grade NS, Class 25, Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.
- D. One-Part Pourable Urethane Sealant For Use T: Type S, Grade P, Class 25, and complying with the following requirements for Uses:
 - 1. Uses T, M and, as applicable to joint substrates indicated, O.
- E. One-Part Nonsag Solvent-Release-Curing Polymerized Butyl Sealant: Complying with FS TT-S-001657, Type 1 and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.
- F. Products:
 - 1. Single Component Mildew-Resistant Acid Curing Silicone Sealant (ES-1):
 - a. Products:
 - 1) "Dow Corning 786"; Dow Corning Corp.
 - 2) "SCS 1702 Sanitary"; General Electric Co.
 - 3) "863 #345 White"; Pecora Corp.

- 4) "Rhodorsil 6B White"; Rhone-Poulenc Inc.
 - 5) " Tremsil 200 White"; Tremco Corp.
 - 6) "OmniPlus"; Sonneborn Bldg Prod. Div., Rexnord Chem. Prod. Inc.
- b. Type Grade: S (single component) and NS (nonsag).
 - c. Class: 25.
 - d. Uses Related to Exposure: NT (nontraffic).
 - e. Uses Related to Joint Substrates: G, and A, as applicable to joint substrates indicated, O.
 - 1) Use O Joint Substrates: Ceramic tile.
2. Single Component Nonsag Urethane Sealant (ES-2):
- a. Products:
 - 1) "Chem-Calk 900", Bostik Constr. Prod. Div.
 - 2) "Chem-Calk 2639", Bostik Constr. Prod. Div.
 - 3) "Dynatrol I"; Pecora Corp.
 - 4) "Permapol RC-1", Prod. Research & Chem. Corp.
 - 5) "Sikaflex-1a"; Sika Corp.
 - 6) "Sikaflex-15LM"; Sika Corp.
 - 7) "Sonolastic NP 1"; Sonneborn Bldg Prod. Div.
 - 8) "Dymonic"; Tremco Inc.
 - b. Type and Grade: S (single component) and NS (non-sag)
 - c. Class: 100/50.
 - d. Uses Related to Exposure: NT (non-traffic).
 - e. Uses Related to Joint Substrates: M, A, and as applicable to joint substrates indicated, O.
 - 1) Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, granite, ceramic tile, and wood.
3. One-Part Pourable Urethane Sealant (ES-3):
- a. Products:
 - 1) "Chem-Calk 950"; Bostik Const. Prod. Div.
 - 2) "NR-201 Urexpan"; Pecora Corp.
 - 3) "Sonolastic SL-1"; Sonneborn Bldg. Prod. Div., Rexnord Chemical Prod. Inc.
 - b. Type and Grade: S (single component) and NS (nonsag)
 - c. Class: 25.
 - d. Uses Related to Exposure: T (traffic).
 - e. Uses Related to Joint Substrates: M, A, and as applicable to joint substrates indicated, O.
 - 1) Use O Joint Substrates: Brick, granite, stainless steel, ceramic tile, and wood.
4. Butyl Rubber Based Solvent Release Joint Sealant (SRS-1):
- a. Products:

- 1) "BC-158," Pecora Corp.
 - 2) "PTI 757," Protective Treatments, Inc.
 - 3) "Sonneborn Multi-Purpose Sealant," Sonneborn Building Products Div., Rexnord Chemical Prod. Inc.
 - 4) "Tremco Butyl Sealant," Tremco, Inc.
- b. Uses Related to Exposure: NT (nontraffic).
- c. Uses Related to Joint Substrates: M, A, only where indicated.

2.03 COMPRESSION SEALS

- A. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:
1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, compatible with joint substrates and other joint sealers.
 2. Impregnating Agent: Neoprene rubber suspended in chlorinated hydrocarbons.
 3. Density: 9-10 lb/cu ft.
 4. Backing: Pressure sensitive adhesive, factory applied to one side, with protective wrapping.
 5. Products:
 - a. "Emseal"; Emseal Corp.
 - b. "Emseal Greyflex"; Emseal Corp.
 - c. "Will-Seal 250"; Wil-Seal Construction Foams Div., Illbruck.
 - d. "York-Seal 200"; York Manufacturing, Inc.
- B. Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open-cell compression type complying with ASTM D 2628 and with requirements indicated for size, profile and cross-sectional design.
1. The D.S. Brown Co.
 2. Watson-Bowman & Acme Corp.

2.04 JOINT SEALANTS FOR PAVING

- A. Hot-Poured Elastomeric Sealant for Concrete and Asphalt Pavements: Manufacturer's standard sealant for concrete and asphalt pavement joints complying with ASTM D3405.
- B. Products:
1. "Hotpour Spec"; J. & P. Petroleum Products, Inc.
 2. "Hi-Spec"; W.R. Meadows, Inc.

2.05 FIRE-RESISTANT JOINT SEALERS

- A. As specified in Section 07 84 00, Firestopping.

2.06 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are

approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Bi-cellular material with a surface skin.
 - 2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, non-outgassing in unruptured state.
 - 3. Proprietary, reticulated, closed-cell polymeric foam, non-outgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D1623, and with water absorption less than 0.02 gms/cc per ASTM C1083.
 - 4. Any material indicated above.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as specified by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

- A. Primer: Provide type specified by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.
- D. Accessory Materials for Fire-Stopping Sealants: Provide forming, joint fillers, packing and other accessory materials required for installation of fire-stopping sealants as applicable to installation conditions indicated.

2.08 JOINT FILLERS FOR CONCRETE PAVING

- A. General: Provide joint fillers of thickness and widths indicated.
- B. Bituminous Fiber Joint Filler: Preformed strips of asphalt saturated fiberboard, complying with ASTM D1751.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with specifications of joint sealer manufacturers and the following requirements:
1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellants; water; surface dirt; and frost.
 2. Clean concrete, masonry, and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates where indicated or where specified by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's specifications. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with specifications of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Solvent-Release-Curing Sealant Installation Standard: Comply with requirements of ASTM C1193 for use of solvent-release-curing sealants.
- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths, which allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers, which have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
 - 3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents, which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 8A in ASTM C1193, unless otherwise indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's specifications.
- H. Installation of Preformed Hollow Neoprene Gaskets: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's specified adhesive to joint substrates immediately prior to installing gaskets. For straight sections provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gasket together to provide watertight joint. Recess gasket below

adjoining joint surfaces by 1/8 inch to 1/4 inch.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

- A. Joint Sealant Application: Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.
 - 1. Joint Sealant: ES-2.
 - 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- B. Joint Sealant Application: Exterior horizontal nontraffic and traffic, isolation and contraction joints in cast-in-place concrete slabs.
 - 1. Joint Sealant: ES-3.
 - 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- C. Joint Sealant Application: Exterior butt joints between metal panels.
 - 1. Joint Sealant: ES-2.
 - 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- D. Joint Sealant Application: Exterior vertical joints between different materials listed above.
 - 1. Joint Sealant: ES-2.
 - 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- E. Joint Sealant Application: Exterior control and expansion joints in ceilings and other overhead surfaces.
 - 1. Joint Sealant: ES-2.
 - 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- F. Joint Sealant Application: Only where specifically indicated.
 - 1. Joint Sealant: SRS-1.
 - 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.

- G. Joint Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
1. Joint Sealant: ES-2.
 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- H. Joint Sealant Application: Interior perimeter joints of exterior openings.
1. Joint Sealant: ES-2.
 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- I. Joint Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors and counters.
1. Joint Sealant: Single-component, mildew-resistant, neutral curing silicone sealant, ES-1.
 2. Joint-Sealant Color: White.
- J. Joint Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
1. Joint Sealant: ES-2.
 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.
- K. Joint Sealant Application: Interior control, expansion, and isolation joints in horizontal traffic surfaces of dimension stone flooring, concrete and threshold setting mastic.
1. Joint Sealant: ES-3.
 2. Joint-Sealant Color: As selected by Commissioner from manufacturer's full range.

END OF SECTION 07 90 00

SECTION 08 11 10
STANDARD STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following products manufactured in accordance with SDI Recommended Standards:
1. Doors: Seamless, hollow or composite construction standard steel doors for interior locations.
 2. Frames: Pressed steel welded unit frames.
 3. Assemblies: Provide standard steel door and frame assemblies as required for thermal rated (insulated).
 4. Provide factory primed doors and frames to be field painted.
- B. Related sections: The following sections contain requirements that relate to this section:
1. Section 08 71 00, Door Hardware
 2. Section 08 80 00, Glass Glazing
 3. Section 09 90 00, Painting

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of door and frame specified, including details of construction, materials, profiles, dimensions, hardware preparation, core, label compliance, sound ratings, fire ratings, and finishes.
- C. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items. Show locations, elevations, sizes and details for louvers.
1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

1.04 QUALITY ASSURANCE

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
1. Test Pressure: Test at atmospheric pressure.
 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested

assemblies provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

3. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering standard steel doors and frames which may be incorporated in the work include; but are not limited to, the following:
 1. Standard Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Ceco Corp.
 - c. Curries Company.
 - d. Fenestra Corp.
 - e. Pioneer Industries.
 - f. Republic Builders Products.
 - g. Steelcraft Manufacturing Co.

2.02 MATERIALS

- A. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 653/A 653, or drawing quality, hot dipped galvanized in accordance with ASTM A 924, with A60 or G60 coating designation, mill phosphatized.
- B. Supports and Anchors: Fabricate of not less than 16-gage sheet steel; galvanized after fabrication.
- C. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.
- D. Zinc-rich touch-up primer: 95 percent metallic zinc dust primer in a vehicle compatible with the specified painting system.

- E. Shop Applied Paint: Apply after fabrication.
 - 1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.03 DOORS

- A. Provide metal doors of SDI grades and models specified below or as indicated on drawings or schedules:
 - 1. Interior Doors: ANSI/SDI-100, Grade III, heavy-duty, Model 4.
 - 2. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4.
- B. Provide flush design doors, 1-3/4" thick, seamless hollow construction, unless otherwise indicated.
- C. For single-acting swing doors, bevel both vertical edges 1/8" in 2".
- D. Provide filler of mineral-wool, honeycomb, polyurethane, polystyrene, rigid mineral fiber core or other approved insulating material solidly packed to full door height filling all voids between inner core reinforcing members on inside of face sheets where appropriate in accordance with SDI standards. No asbestos products will be allowed.
- E. Fabricate doors of two outer, galvanized, steel sheets not less than 16 gauge. Construct doors with smooth, flush surfaces without visible joints or seams on exposed surfaces. Provide weep hole openings in the bottom of doors to permit escape of entrapped moisture.
- F. Reinforce inside of doors with vertical sheet steel sections not less than 18 gauge. Space vertical reinforcing 6" o.c. and extend full door height. Spot-weld at not more than 5" o.c. to both face sheets.
- G. Reinforce tops and bottoms of doors with 12 gauge horizontal steel channels spot welded to outer sheets. Close top and bottom edges to provide a weather seal, as integral part of door construction or by addition of inverted steel channels.

2.04 FRAMES

- A. Provide metal frames for doors and louver transoms of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated.
- B. Fabricate frames of minimum 12 gauge galvanized steel.
- C. Fabricate frames of full welded construction, with corners mitered, reinforced, continuously welded full depth and width of frame.
- D. Mullions and transom bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
- E. Jamb anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 16 gauge galvanized steel.
- F. Floor anchors: Provide floor anchors for each jamb and mullion which extends to floor,

formed of not less than 14 gauge galvanized steel sheet, as follows:

1. Monolithic concrete slabs: Clip type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.
- G. Spreader bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- H. Door Silencers: Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- I. Form fixed stops integral with frame, unless noted otherwise.

2.05 LOUVERS

- A. Door Louvers: Provide sightproof stationary louvers for doors where indicated, 85 percent free area, flush style frame with tamperproof fasteners; constructed of inverted V-shaped or Y-shaped blades formed of 24-gauge galvanized steel set into minimum 20-gauge galvanized steel frame. Louver assembly to be set into door as shown on shop drawings or into transom portion of steel frame.
- B. Where shown or required, provide operable damper for louver. Louver to be operable manually or automatically by thermostat as shown.
- C. Fire-Rated Automatic Louvers: Louvers constructed with movable blades or damper closed by actuating fusible links at 150 degrees F (65 degrees C) and labeled and listed for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same inspecting and testing agency who established fire-resistance rating of door assembly.
- D. Provide stainless steel mesh insect screen and frame for exterior louvers.

2.06 FABRICATION

- A. Fabricate steel door, frame and louver units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.
 1. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.
 2. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- B. Fabricate doors, panels, louvers, and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of doors as integral part of door construction or by addition of galvanized inverted steel channels. Fabricate concealed stiffeners, reinforcement, edge channels, moldings from galvanized steel.
- C. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible.
- D. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- E. Thermal-Rated (Insulating) Assemblies: Provide doors fabricated as thermal insulating

door and frame assemblies and tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.41 Btu/(hr x sq ft x deg F.) or better.
- F. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 Series Specifications for door and frame preparation for hardware.
1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.
- G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.
- H. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.
- I. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
 2. Apply approved zinc-rich primer to galvanized surfaces damaged in fabrication.
 3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution or hot phosphate solution.
 4. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
 5. Apply finish coat to doors indicated to be prefinished by spraying and baking, to produce a paint thickness of 1.25 mils.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install standard steel doors, frames, louvers, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames," unless otherwise indicated.
1. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 2. Grout all frames at masonry walls solid.
- C. Set frames in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- D. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

- E. Install fire-rated frames in accordance with NFPA Standard No. 80.

3.02 ADJUST AND CLEAN

- A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

END OF SECTION 08 11 10

SECTION 08 13 00
STAINLESS STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following products manufactured in accordance with SDI Recommended Standards:

1. Doors and Frames: Seamless, hollow or composite construction stainless steel doors, sidelights and frames.
2. Assemblies: Provide door and frame assemblies as required for thermal rated (insulated).
3. Louvers: Stainless steel louvers set in the door or in the frame as a transom.

1.03 RELATED WORK

- A. Related sections: The following sections contain requirements that relate to this section:

1. Division 04 Section for building in of anchors and grouting of frames in masonry construction.
2. Division 08 Section for door hardware.
3. Division 08 Section for glass and glazing.

1.04 REFERENCES

- A. ANSI/NFPA 80 - Fire Doors and Windows.
- B. ANSI A250.4 – Test procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
- C. ANSI/ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- D. ASTM A 480 – Standard Specification for General Requirements for Flat-Rolled Stainless and Heat- Resisting Steel Plate, Sheet and Strip.
- E. ASTM E152 - Methods of Fire Tests of Door Assemblies.
- F. NAAMM CHM-1-74 - Recommended Architectural Specifications for Custom Hollow Metal Doors and Frames.
- G. NAAMM Hollow Metal Technical and Design Manual - Section 6: Installation of Doors and Frames.
- H. NAAMM Hollow Metal Technical and Design Manual - Section 8: Fire Rated Door and Frames.
- I. NFPA 252 - Fire Tests of Door Assemblies.
- J. SDI 100 - Steel Door Institute Recommended Specifications - Standard Steel Door and

Frames.

- K. SDI 117 – Manufacturing Tolerances Standard Steel Doors and Frames.
- L. UL 10B - Fire Tests of Door Assemblies.
- M. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- N. ASTM E2074 – Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- O. DHI A115.IG – Installation Guide for Doors and Hardware.
- P. NAAMM CHM-1-74 – Recommended Architectural Specifications for Custom Hollow Metal Doors and Frames.

1.05 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of door, frame and louver specified, including details of construction, materials, profiles, dimensions, hardware preparation, core, label compliance, sound ratings, and fire ratings.
 - 1. Provide sample of stainless steel finish.
- C. Shop drawings showing fabrication and installation of stainless steel doors, frames and louvers. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items. Show locations, elevations, sizes, and details for louvers.
 - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: Test at atmospheric pressure.
 - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 3. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Authority; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering standard steel doors and frames which may be incorporated in the work include; but are not limited to, the following:
 - 1. Stainless-Steel Doors and Frames:
 - a. Curries Company.
 - b. Emerson Engineering, Co., Inc.
 - c. Fenestra Corporation.
 - d. Next Door Co.
 - e. Approved Equal.

2.02 MATERIALS

- A. Stainless Steel for Frame, Sidelights and Door: ASTM A480, rollable temper steel, Type 304; No. 4 finish, vertical strokes, unless noted otherwise.
- B. Frame Reinforcement: ASTM A525 sheet steel with 1.25 oz/sq ft galvanized coating.
- C. Supports and Anchors: Fabricate of not less than 16-gage sheet steel; galvanized after fabrication.
- D. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.

2.03 DOORS

- A. Provide metal doors consisting of stainless steel face sheets, 2 layers, 18 gauge thickness each.
- B. Provide flush design doors, 1-3/4" thick, seamless hollow construction, unless otherwise indicated.
- C. For single-acting swing doors, bevel both vertical edges 1/8" in 2".
- D. Construct doors with smooth, flush surfaces without visible joints or seams on exposed surfaces.

- E. Core:
1. Metallic core construction: Steel-Stiffened Core: 0.026" stainless steel vertical stiffeners extending full-door height, spaced not more than 6" o.c. and spot welded to face sheets a maximum of 6 inches o.c. Fill spaces between stiffeners with insulation of minimum 0.6-lb/cu. Ft. density.
 2. Nonmetallic Core Construction: Polystyrene Core, minimum 0.9-lb/cu.ft. Density with not less than 18-psi shear strength, rigid, foam polystyrene core board complying with ASTM C 578, Type I; laminate with waterproof adhesive to both door faces. Vertical stainless steel stiffeners.
- F. Reinforce tops and bottoms of doors with inverted 18 gauge horizontal stainless steel channels spot welded not more than 6" o.c. to outer sheets; webs of channels flush with the top or bottom of the door. Seal joints in top edge of door to provide a weather seal. Provide weep hole openings in the bottom of doors to permit escape of entrapped moisture.

2.04 PANELS

- A. Provide panels of same material, construction, and finish as specified for doors.

2.05 FRAMES

- A. Provide stainless steel frames for doors and louver transoms of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated.
- B. Fabricate frames of minimum 14 gauge stainless steel with No.4 finish.
- C. Fabricate frames of full welded construction, with corners mitered, reinforced, continuously welded full depth and width of frame.
- D. Mullions and transom bars: Provide closed or tubular mullions and transom bars of same material and thickness as frame where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
- E. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
- F. Jamb anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 16 gauge galvanized steel.
1. Masonry construction: Adjustable, flat, corrugated, or perforated, t-shaped to suit frame size, with leg not less than 2" wide by 10" long. Furnish at least three anchors per jamb up to 7'-6" height and four elsewhere.
 2. Existing masonry or concrete construction: Expansion anchors, size as recommended by frame manufacturer.
- G. Floor anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gauge galvanized steel sheet, as follows:
1. Monolithic concrete slabs: Clip type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.
- H. Spreader bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- I. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on

strike jambs of single-door frames and 2 silencers on heads of double-door frames.

- J. Plaster Guards: Provide minimum 26-gage galvanized steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- K. Form fixed stops integral with frame, unless noted otherwise.
- L. Paint inside of frame profile with coating to a thickness of 1/16 inch using fibered asphalt emulsion.

2.06 LOUVERS

- A. Door Louvers: Provide sightproof and weatherproof stationary louvers for doors where indicated, 85 percent free area, flush style frame with tamperproof fasteners; constructed of inverted V blade or Z-shaped blades formed of 16-gauge roll formed stainless steel set into U-shaped stainless steel frame. Blades to be 1 3/8" wide and spaced not more than 2" o.c. Assemble units by welding. Louver assembly to be set into door as shown on shop drawings or into transom portion of stainless steel frame and secured with tamperproof fasteners.
- B. Where shown or required, provide operable damper for louver. Louver to be operable manually or automatically by thermostat as indicated.
- C. Fire-Rated Automatic Louvers: Louvers constructed with movable blades or damper closed by actuating fusible links at 150 degrees F (65 degrees C) and labeled and listed for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same inspecting and testing agency who established fire-resistance rating of door assembly.
- D. Provide insect screen and frame for exterior louvers. Install screen on interior side of louver frame, consisting of 18-by-14 mesh formed with 0.011" diameter stainless steel wire in rigid, formed stainless steel frame.

2.07 FABRICATION

- A. Fabricate stainless steel door, sidelight and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI A250.4 requirements.
 - 1. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.
 - 2. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- B. Fabricate doors, panels, louvers, and frames from stainless steel. Close top and bottom edges of doors as integral part of door construction or by addition of stainless steel inverted channels. Fabricate concealed stiffeners, reinforcement, edge channels, moldings from stainless steel.
- C. For doors with metallic core construction, weld cores to both face sheets. For doors with nonmetallic core construction, laminate core material to both door face sheets with waterproof adhesive.

- D. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible.
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- F. Thermal-Rated (Insulating) Assemblies: Provide doors fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.41 Btu/(hr x sq ft x deg F.) or better.
- G. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 Series Specifications for door and frame preparation for hardware.
 - 1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.
- H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.
- I. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute. Conform to ANSI A117.1 for positioning requirements for the handicapped.
- J. Glass and Glazing: Reference Glazing section of these specifications.

2.08 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured polish finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 1. Brushed No. 4 finish.
 - 2. When polishing is completed, pasivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, DHI A115.IG, and as herein specified.
- B. Placing Frames:
 - 1. Except for frames located at existing concrete or masonry installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 2. In masonry construction, locate wall anchors adjacent to hinge locations on hinge jamb and at corresponding heights on strike jamb, minimum three per side.
 - 3. At existing walls, secure frames to adjacent construction with bolts and anchorage

devices.

- C. Set frames in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- D. Shim frames as required with steel shims, insulate shim space.
- E. In masonry construction, coordinate frame setting with the building of masonry walls. Remove spreader bars only after frames or bucks have been properly set and secured.
- F. Door Installation: Fit stainless steel doors accurately in stainless steel frames, within clearances specified in ANSI A250.8.
- G. Install fire-rated frames in accordance with NFPA Standard No. 80.

3.02 ADJUST AND CLEAN

- A. Stainless-Steel Touchup: Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.
- B. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

END OF SECTION 08 13 00

SECTION 08 41 10
ALUMINUM ENTRANCES AND FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this section.

1.02 SUMMARY

- A. This Section includes:

1. Aluminum framing for curtainwall systems, exterior openings and entrance door assemblies; and including aluminum and glass 'monumental-type" doors, sidelights and transoms.

1.03 RELATED SECTIONS

- A. Other specification sections that are related to the Work of this Section:

1. Division 08 Section, "Finish Hardware" for door hardware.
2. Division 08 Section, "Glass and Glazing" for glazing systems for curtainwalls, exterior openings, entrances and doors.

1.04 REFERENCES

- A. AA – Aluminum Association, Designation System for Aluminum Finishes.
- B. AAMA – Metal Curtain Wall, Window, Storefront and Entrance – Guide Specifications Manual.
- C. AAMA – 611-98 – Finish on Exposed Aluminum Shall be Compliant With the Performance Standards Set Forth.
- D. ASTM B209 – Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- E. ASTM B221 – Standard Specification for Aluminum and Aluminum –Alloy Extruded Bars, Rods, Wires, Profiles.
- F. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
- G. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- H. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.05 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's data, recommendations, and standard details, including fabrication, finishing, hardware, accessories and other components of the Work.
- B. Shop Drawings: Submit Shop Drawings for the fabrication and installation of all the components of the work signed and sealed by a licensed State of Illinois Structural Engineer stating compliance with "Quality Assurance" requirements. Include wall elevations at 1/2" scale and half-size detail sections of every typical composite member. Show dimensions, profiles, anchors, joint system, expansion provisions and other components not included in manufacturer's standard data.
 - 1. Include glazing details.
 - 2. Show attachment to substrates.
 - 3. Indicate details for drainage of moisture in the system to the exterior.
 - 4. For entrance doors, include hardware schedule, indicating number, type, hand, function, manufacturer, catalog number, and finish of entrance door hardware.
 - 5. For doors and frames, indicate internal reinforcing and internal reinforcing at corners.
- C. Samples: Submit color and finish choices for factory finish.
 - 1. Submit a set of two (2) samples of selected aluminum finish(es), showing extremes of color and appearance, on minimum 4" long extrusions of the alloys to be used for the Work for verification.
 - 2. If required by the Authority, submit samples of typical fabricated sections, showing joints, anchorage, exposed fastenings (if any), expansion provisions, glazing provisions, flashing and drainage, quality of workmanship, hardware and accessory items, before fabrication of the Work proceeds.
 - a. Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components.
- D. Certification: Submit written certifications, signed by window wall manufacturer, attesting that system conforms to each of the "Quality Assurance" requirements of this Specification where the manufacturer's standard system has been tested in accordance with specified tests and meets performance requirements specified. Where such testing has not been accomplished, perform required tests through a recognized testing laboratory or agency and provide certified test results.
- E. Maintenance Data: For aluminum framing and doors, to include in maintenance manuals.
- F. Warranties: Sample of warranties for aluminum framing, doors, and finish

1.06 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.07 QUALITY ASSURANCE

- A. Standards: Comply with the requirements and recommendations in applicable specifications and standards by NAAMM, AAMA and AA, including the terminology definitions, and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated. Conform to 16 CFR 1201.
- B. Qualifications:
1. Manufacturer: Minimum of five (5) years experience with the manufacturing of aluminum entrances and framing systems of similar scope to that required for this project.
 2. Installer: Regularly engaged in installations of the types of Work required and acceptable to the system manufacturer.
 3. Testing Agency: Qualified according to ASTM E 699 for testing indicated.
- C. Wind Loading: Fabricate exterior units to withstand the wind pressure loading of 30 lbs. per sq. ft. on the gross area of the system, acting inward and also acting outward except 40 lbs per sq. ft. at corners when tested in accordance with ASTM E 330.
- D. Deflections and Thermal Movements: Design work and internally reinforce component members to withstand wind pressures, building deflections, construction shrinkage, thermal movements and erection tolerances, within the following deflection limitations and temperature variations without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance or other detrimental effects. Fabricate, assemble and erect the work to maintain these limitations.
1. Deflections Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus ¼ inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to ¾ inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.
 3. Thermal expansion and contraction movement capability, resulting from not less than an ambient temperature range of 120°F, which may cause a window wall material temperature range of 180°F.
 4. Building deflection of L/360.
- E. Water and Air Leakage: Design, fabricate, assemble and erect work and system of sealed joints with other work, to be permanently free of significant leakage of both water and air. Significant leakage is defined as follows, based on a differential test pressure amounting to 20% of specified strength performance pressure required, testing a complete module of window wall work.
1. Air Infiltration (Framing): More than 0.06 cu. ft. per minute per sq. ft. (projected area of module), determined by ASTM E 283 at an inward test pressure of 6.24 PSF.
 2. Air Infiltration (Doors): Provide doors with an air infiltration rate of not more than 0.50 CFM for single doors and 1.0 for pairs of doors when tested in accordance with ASTM E 283 at an inward test pressure differential of 1.567 PSF.
 3. Water Penetration: Provide framing systems with no water penetration (excluding operable door edges) as defined in the test method when tested in

accordance with ASTM E 331 at an inward test pressure differential of 6.24 lbf. per sq. ft.

- F. Condensation Requirements: Provide thermal-break construction, which provides a condensation resistance factor (CRF) of at least 55 per the requirements of AAMA 1502.7
- G. Thermal Performance: Provide window wall system and doors having maximum U-factor of 0.57 for fixed units and 0.67 for operable units as determined in accordance with NFRC 100 by a laboratory accredited by a nationally recognized accreditation organization such as the National Fenestration Rating Council and labeled and certified by the manufacturer; and assembly maximum solar heat gain coefficient (SAGC) of 0.49 for north orientation and 0.39 for all other orientations for overall glazed area as determined in accordance with NFRC 200 by a laboratory accredited by a nationally recognized accreditation organization such as the National Fenestration Rating Council and shall be labeled and certified by the manufacturer. Shading coefficient of the center of glass multiplied by 0.86 shall be an acceptable alternate for determining compliance with the SHGC required for the overall glazed area. Shading coefficient shall be determined using special data file determined in accordance with NFRC 300. Shading coefficient shall be verified and certified by the glass unit manufacturer.
1. U-Factors from 8.1 of ASHRAE IESNA Standard 90.1-1999 shall be an acceptable alternate for determining compliance with the U-factor criteria. Where credit is being taken for a low-emissivity coating, the emissivity of the coating shall be determined in accordance with NFRC 301. Emissivity shall be verified and certified by the window wall manufacturer.
- H. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
1. Do not revise intended aesthetic effects, as judged solely by the Authority, except with Authority's approval.
- I. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- J. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.
- K. Mockups: If required by the Authority, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical wall area as shown on Drawings.
 2. Field testing shall be performed on mockups according to the requirements set forth herein.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Authority specifically approves such deviations in writing.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion and approved by the Authority.

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum entrances, framing and doors that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Noise or vibration caused by thermal movements.
- c. Deterioration of metals or metal finishes and other materials beyond normal weathering.
- d. Sealant failures.
- e. Water leakage through fixed glazing and framing areas.
- f. Failure of operating components.

2. Warranty Period: Ten years from the date of final acceptance.

- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Twenty (20) years from date of Final Acceptance.

1.10 MAINTENANCE SERVICE

A. Entrance Door Hardware

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Final Acceptance, provide 12 months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Butler; Vistawall
 2. Efco
 3. Kawneer
 4. Pittco
 5. Special-Lite
 6. Tubelite
 7. U.S. Aluminum
 8. Approved equal.

2.02 MATERIALS AND ACCESSORIES

- A. Aluminum Extrusions: Provide alloy and temper as recommended by manufacturer for strength, corrosion resistance, application of required finish and control of color, but not less than 6063-T5 alloy and temper and 22,000-psi ultimate tensile strength. Provide main extrusions of not less than 0.125" wall thickness. Framing to be thermally broken with high performance plastic connectors.
1. Framing members to be manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- B. Aluminum face sheets when used to be .062" thick architectural-quality 5005 alloy, secured on all four sides, without screws and by full length integral reglets on the edges of the stiles and rails.
- C. Fasteners: Aluminum, nonmagnetic stainless steel or other non-corrosive metal fasteners guaranteed by the manufacturer to be compatible with the doors, frames, stops, hardware, anchors and other items being fastened. For exposed fasteners (if any), provide Phillips flat-head screws with finish matching the item fastened.
1. Do not use exposed fasteners except where unavoidable for the assembly of units, and unavoidable for the application of hardware. Provide only concealed screws in glazing stops.
 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 3. Reinforce members as required to receive fastener threads.
 4. Any fasteners that must be exposed must have countersunk Phillips screw heads and be fabricated from stainless steel.
 5. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- D. Steel Reinforcement and Brackets: Manufacturer's standard formed or fabricated steel units, of shapes, plates or bars; with 2.0 oz. hot-dip zinc coating complying with ASTM A 123, applied after fabrication to brackets and rust inhibitive paint applied to reinforcing elements.
- E. Concealed Flashing: Dead soft stainless steel, minimum 26 gauge.
- F. Inserts: For required anchorage into concrete or masonry work, furnish inserts of cast iron, malleable iron or 12 gauges steel hot-dip galvanized after fabrication.

- G. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- H. Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PAINT 12, compounded for 30-mil thickness per coat.
- I. Sealants and Gaskets: Provide sealants and gaskets in the fabrication, assembly and installation of the Work, which are recommended by the manufacturer to remain permanently elastic, non-shrinking, non-migrating and weatherproof for the life of the building.
- J. Glazing for curtainwall and doors: Glass is installed with aluminum snap-in glass stops, cushioned by a glazing gasket. Stops to be fixed at the exterior and mechanically fastened and removable at the interior. Provide manufacturer's standard stripping of molded neoprene at all four sides of the glazing and installed in a "captive" assembly of glazing stops. Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
 - 1. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
 - 2. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- K. Glazing: See Glass and Glazing section of these specifications.

2.03 HARDWARE

- A. Except as indicated otherwise herein, refer to Section "Door Hardware" of these Specifications for the furnishing of hardware items. Hardware to be of "heavy duty" type. Hardware templates will be furnished to the manufacturer for the fabrication of door and frames to receive hardware. Receive the hardware and coordinate with the hardware requirements of this Section. Report discrepancies in writing to the Contractor.
- B. Cut, reinforce, drill and tap frames and doors as required to receive hardware, except do not drill and tap for surface-mounted items until the time of installation at the Project Site. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- C. Install all hardware, except surface-mounted hardware, at the fabrication plant. Remove only as required for final finishing operations, and for delivery and installation of the Work at the Project Site.

2.04 FABRICATION

- A. Coordination of Fabrication: Wherever possible, check the actual openings in the construction work by accurate field measurement before fabrication, and show recorded measurements on final Shop Drawings.
- B. Prefabrication: Provide each door as a "packaged entrance" unit. Complete the fabrication, assembly, finishing, application of hardware and all other Work, before shipment to the Project Site, to the greatest extent possible. Disassemble only to the extent necessary for shipment and installation.
- C. Basic Fabrication:
 - 1. Form or extrude aluminum shapes before finishing.

2. Complete the cutting, fitting, forming, drilling and grinding of all metal at the shop to the extent possible. Remove arrises from cut edges and ease edges and corners to a radius of approximately 1/64".
 3. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld splatter and welding oxides from exposed surfaces by descaling or grinding.
 4. Conceal fasteners, anchors, and connection devices wherever possible, except as otherwise shown.
 5. Maintain continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.
 6. Internally reinforce the frames and doors as necessary for performance requirements, and for support to the structure. Internally reinforce doors and frames for installing hardware. Separate dissimilar metals with bituminous paint or preformed separators, which will prevent corrosion. Separate metal surfaces at moving joints with nonmetallic separators to prevent "freeze-up" of joints.
- D. Weather Stripping: Where exterior door stiles or head rails do not close against fixed stops equipped with compression weather stripping, provide sliding weather stripping, retained in an adjustable strip in a mortise centered in the edge of the door. Provide heavy-duty, hollow, compression weather stripping in the bottom-rail, adjustable for contact with the threshold.
- E. Stile-and-Rail Type Aluminum Doors:
1. Provide tubular frame members, fabricated with mechanical joints of heavy inserted reinforcing plates and concealed tie-rods or j-bolts, in accordance with manufacturer's standard fabrication methods. Fabricate with structurally welded joints, at manufacturer's option and with the Authority's approval.
 - a. Mitered corner joints to be secured by angle blocks. Doors to be internally reinforced with full width heavy steel 3/8" galvanized tensioned tie rods and interlocking rigid corners, holding the nested corners together.
 - b. Voids to be filled with poured in place urethane core.
 2. Doors to be of "monumental type design".
 3. Except as otherwise shown or scheduled, provide door units 1-3/4" thick minimum.
 - a. Provide wide stile doors; with 5" sides and top and 7" or 10" (as selected by the Authority) bottom unless indicated or approved otherwise.
 4. Egress Door Opening-Force Requirements: Not more than 30 lbf required to set the door in motion and not more than 15 lbf to open the door to its minimum required width or release the latch.
 5. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.
 6. Weather Stripping:
 - a. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - b. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
 7. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

8. Silencers: BHMA A156.16, Grade 1.
9. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of ½ inch.
10. Factory install entrance door hardware to greatest extent possible. When possible, cut, drill, and tap for entrance door hardware before applying finishes.
11. Push bars and pull handles to be fastened to door with steel stud passing thru stile, and connecting the two sides.

F. Aluminum Framing:

1. Fabricate tubular and channel frame assemblies with either welded or mechanical joints using shear blocks with concealed fasteners wherever possible.
2. Provide non-removable doorstops extruded integrally with frame to extent possible.
 - a. Provide compression weather-stripping on the door-contact face of doorstop for exterior door frames, and on other frames where indicated.
 - b. Where weather stripping is not provided, install neoprene silencers on doorstops to prevent metal-to-metal contact between doors and stops.
3. Provide glazing system for frames to receive lights. Design system for replacement of glass, but for non-removal of glass from the exterior. Glazing stops for frames and doors to be square snap-on extruded aluminum and preformed gaskets.
4. Fabricate frame and door assemblies for exterior walls with flashing and weeps to drain penetrating moisture or condensation to exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.
5. Provide all elements with thermal breaks to positively eliminate outside to inside metal contact. Provide thermal break materials certified to comply with Performance Requirements of the unit in each case (window or window wall).
 - a. Interior framing need not be thermal break construction.

- G. Framing for curtainwall to be 2" X 4" unless indicated otherwise on the drawings or otherwise required to meet the structural or other requirements of this specification.

2.05 ALUMINUM FINISHES

- A. Prepare the surfaces for finishing in accordance with recommendations of the aluminum producer and the finisher or processor.
- B. Finish all components of each assembly simultaneously so as to attain complete uniformity of color. Adjust and control the direction of mechanical finishes (as specified) to achieve the best overall visual effect in the Work, as determined in consultation with the Authority.
- C. Sequence the finishing and processing of materials in a predetermined bay-by-bay plan, which will minimize color and texture differences between adjacent components.
- D. Color and Texture Tolerance:
 1. The right is reserved to reject the Work because of color or texture variations, which are visually objectionable, but only where the variation exceeds the range of variations established by the manufacturer prior to the Work, by means of range samples which have been accepted by the Authority.

2. Prepare range samples on extrusions of profiles and shapes of the actual members of the Work. Establish range samples to maintain a total range of 2 degrees on the green reflectance scale.
- E. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
 - F. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
 - G. Pretreatment: Applicator to pre-treat the Aluminum with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by a chrome phosphate or chrome free conversion coating to ensure adhesion of paint to aluminum.
 - H. Class I, Clear Anodic AA-M12C22A41, Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm (.7 mil) or thicker complying with AAMA 611.
 - I. Class I, Color Anodic Finish: AA-M12C22A44 Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm (.7 mil) or thicker complying with AAMA 611.
 1. Color as selected by Authority from manufacturer's standards.
 - J. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color as selected by Authority from manufacturer's standards.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not install component parts, which are observed to be defective in any way, including warped, bowed, dented, abraded and broken members, including glass and edge damage. Remove and replace members, which have been damaged during installation.
- B. Deliver base plates for mullion anchorage in time to allow for installation. Provide setting drawings.

3.02 INSTALLATION – GENERAL

- A. Comply with manufacturer's written instructions.
- B. Fit joints to produce hairline joints free of burrs and distortions.
- C. Rigidly secure non-movement joints.
- D. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
- E. Seal joints watertight unless noted otherwise.

- F. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- G. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- H. Set continuous sill members and flashing in full sealant bed to produce weathertight installation.
- I. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

3.03 ERECTION TOLERANCES

- A. Limit variations from plumb, and level to the following:
 - 1. 1/8" maximum deviation.
- B. Limit variations from location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:
 - 1. 3/8" total maximum deviation for any member at any location.
 - 2. 1/8" maximum change in deviation for any member at any 10' run, any direction.
- C. Limit offsets in the end-to-end and edge-to-edge alignments of adjoining and consecutive members, which form planes, continuous runs and profiles to the following:
 - 1. 1/16" maximum offset in any flush alignment, including any which are to be 1/2" or less out-of-flush, and including any which are separated 2" or less by a reveal or protrusion in the plane of the wall.
 - 2. 1/8" maximum offset in alignments which are to be out-of-flush by more than 1/2", or separated by a reveal or protrusion of more than 2" width.
- D. Provide sliding connections at top of mullions to accommodate deflections of L/360 of the floor above.

3.04 ERECTION

- A. Erect steel elements in accordance with AISC - Manual of Standard Practice.
- B. Certify welders in accordance with requirements of AWS.
- C. Do not cut, trim, weld or braze components during erection in any manner which would damage the finish, decrease the strength, or result in a visual imperfection or a failure in performance of the window wall. Return component parts, which require alteration to the shop for refabrication, if possible, or for replacement by new parts, if not possible.
- D. Install components level, plumb, true to line and with uniform joints and reveals. Use erection equipment, which will not mark or stain finished surfaces, and will not damage the component parts in any way.

- E. Anchor component parts securely in place by bolting, welding or other permanent mechanical attachment system, which will comply with performance requirements and permit movements which are intended or necessary. Install slip-joints wherever necessary to ensure movement as intended or necessary.
- F. Apply bituminous paint of approximately 30-mil dry film thickness, or other suitable permanent separator, on concealed contact surfaces of dissimilar materials, before assembly or installation.
- G. Wire brush and touch-up prime welded and unshop primed steel.
- H. Provide close fitting sleeves at joints to insure alignment and no open joints.
- I. Provide all closures, panels, sill and stool covers and all other accessory items required for a complete installation. Form accessories of minimum .063" aluminum.
- J. Install fire stopping in accordance with requirements to obtain fire rating.

3.05 GLAZING

- A. Protect glass units from edge damage at all times during handling and installation.
- B. Inspect for edge or surface damage and do not install defective units. The glazer is responsible for correct glass size for each opening, within the tolerances and necessary dimensions established.
- C. The glazer must examine the framing or glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing is to be performed, and notify the Authority in writing of any conditions detrimental to the proper and timely completion of the Work. Start of Work will evidence acceptance of conditions.
- D. Do not install glazing sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
- E. Comply with combined recommendations of glass manufacturer and manufacturer of glazing sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturers' technical representatives direct otherwise.
- F. Comply with "Glazing Manual" and "Glazing Sealing Systems Manual" by Flat Glass Marketing Association, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
- G. Before glazing begins, the Contractor shall conduct a meeting with the glass manufacturer, glazing materials manufacturer, glazer, and Construction Manager to review details of installation.
- H. Glazing Methods:
 - 1. Glaze in exact accordance with requirements necessary to obtain "quality assurance" specified hereinbefore.
 - 2. Immediately upon installation, protect glass from breakage by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surface of glass.
 - 3. Remove and replace glass, which is broken, chipped, cracked, abraded, or damaged in any other way during the installation period.

4. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other surfaces.

3.06 FIELD QUALITY CONTROL

- A. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as required by the Authority. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
- B. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
- C. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. and shall not evidence water penetration.
- D. Repair or remove work if test results and inspections indicate that it does not indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
- B. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.08 PROTECTION AND CLEANING

- A. Protect exposed aluminum work from damage by construction. Use lacquer coating only if totally removed without damage to finish. Use strippable covering only if totally removed without damage to finish. Remove protection and clean surfaces and glass immediately before acceptance of building.

END OF SECTION 08 41 10

SECTION 08 71 00
FINISH HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

- B. Extent of finish hardware required is indicated on drawings and in schedules.

- C. Types of finish hardware required include, but may not be limited to, the following:

1. Hinges
2. Lock cylinders and keys
3. Lock and latch sets
4. Bolts
5. Closers and other door control devices.
6. Overhead holders
7. Exit door hardware.
8. Door trim units
9. Protection plates
10. Weatherstripping for doors
11. Thresholds
12. Stops
13. Astragals or meeting seals on pairs of doors.
14. Lock Guard

- D. Related Sections: The following sections contain requirements that relate to this Section.

1. Doors, Division 08.

1.03 REFERENCES

- A. AAMA 701/702 – Combined Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals, American Architectural Manufacturers Association.
- B. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
- C. ANSI A156.1 (BHMA 101) - Butts and Hinges.
- D. ANSI A156.2 (BHMA 601) - Bored and Preassembled Locks and Latches.
- E. ANSI A156.3 (BHMA 701) - Exit Devices.
- F. ANSI A156.4 (BHMA 301) - Door Controls-Closers.
- G. ANSI A156.5 (BHMA 501) - Auxiliary Locks and Associated Products.

- H. ANSI A156.6 (BHMA 1001) - Architectural Door Trim.
- I. ANSI A156.7 - Template Hinge Dimensions.
- J. ANSI A156.8 (BHMA 311) - Door Controls-Overhead Holders.
- K. ANSI A156.13 (BHMA 621) - Mortise Locks and Latches.
- L. ANSI A156.15 (BHMA 321) - Closer Holder Release Devices.
- M. ANSI A156.16 - Auxiliary Hardware.
- N. ANSI A156.17 - Self Closing Hinges & Pivots.
- O. ANSI A156.18 - Materials and Finishes.
- P. ANSI A156.21 – Thresholds.
- Q. ANSI A156.22 – Door Gasketing.
- R. ANSI A156.26 - Continuous Hinges.
- S. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
- T. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- U. BHMA – Builders Hardware Manufacturers Association.
- V. NFPA 70 - National Electrical Code.
- W. NFPA 80 – Standard for Fire Doors and Fire Windows.
- X. NFPA 101 – Safety to Life from Fire in Buildings and Structures.
- Y. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies.
- Z. UL 305 - Standard for Safety for Panic Hardware.
- AA. UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Authority and Contractor.
- C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA

Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

1. Test Pressure: Test at atmospheric pressure.
- D. ADA and Illinois Accessibility Code Compliance: Unless noted and approved otherwise, all hardware to be in compliance with the requirements of the Americans with Disabilities Act of 1990 (ADA). All public spaces to have an entrance/exit that is ADA and IAC accessible and compliant.
1. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 2. Door Closures: Comply with the following maximum opening-force requirements indicated:
 - a. Interior Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
 4. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Delayed-Egress Locks: Lock released within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds.
 - c. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
 - d. Thresholds: Not more than 1/2 inch high.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
1. UL Standard: Comply with UL 325.
 2. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each item of hardware in accordance with the Special Conditions. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finishes.
- B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
- C. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - 1. Type, style, function, size and finish of each hardware item.
 - 2. Name and manufacturer of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - 5. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - 6. Mounting locations for hardware.
 - 7. Door and frame sizes and materials.
 - 8. Keying information.
- D. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Authority's final instructions on keying of locks has been fulfilled.
- F. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.
- G. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.
- H. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.
- I. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed to Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- J. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in 03 Section, Cast-in-Place Concrete.

1.06 PRODUCT HANDLING

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packaged in same container.
- C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following; or an approved equal:
 - 1. Butts and Hinges:
 - a. Hager Hinge Co.
 - b. McKinney Products Co.
 - c. Stanley Hardware, Div. Stanley Works.
 - 2. Cylinders and Locks (All locks must accept interchangeable Best cylinders):
 - a. Best Lock Corp.
 - b. Corbin & Ruswin Architectural Hardware, Div. Black & Decker Corp. (For Ruswin No.6 only).
 - c. Falcon Lock.
 - 3. Overhead Closers:
 - a. LCN, Div. Ingersoll-Rand Door Hardware Group.
 - 4. Exit Door Hardware:
 - a. Von Durpin 98 Series.

5. Door Trim, Kick, Mop, and Armor Plates:
 - a. Baldwin Hardware Corp.
 - b. Brookline Industries, Div. Yale Security Inc.
 - c. Corbin & Ruswin Architectural Hardware, Div. Black & Decker Corp.
 - d. Hager Hinge Co.
 - e. H. B. Ives, A Harrow Company.
 - f. Glynn-Johnson.
 - g. Hiawatha.

6. Door Stripping, Seals and Astragal:
 - a. Hager Hinge Co.
 - b. National Guard Products, Inc.
 - c. Pemko Manufacturing Co., Inc.
 - d. Reese Enterprises, Inc.
 - e. Zero International, Inc.

7. Thresholds:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co., Inc.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.

8. Lock Guard:
 - a. Ives.
 - b. Hager.

2.02 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:
 1. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required. Manufacturer's name indicated used in the Hardware Schedule is for purposes of establishing minimum requirements. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.
 2. ANSI/BHMA designations used elsewhere in this section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this section.
 - a. Butts and Hinges: ANSI A 156.1 (BHMA 101)
 - b. Locks and Lock Trim: ANSI A 156.2 (BHMA 601)
 - c. Exit Devices: ANSI A 156.3 (BHMA 701)
 - d. Door Controls - Closers: ANSI A 156.4 (BHMA 301)
 - e. Auxiliary Locks: ANSI A 156.5 (BHMA 501)
 - f. Architectural Door Trim: ANSI A 156.6 (BHMA 1001)
 - g. Template Hinge Dimensions: ANSI A 156.7
 - h. Door Controls - Overhead Holders: ANSI A 156.8 (BHMA 311)
 - i. Mortise Locks & Latches: ANSI A 156.13 (BHMA 621)

- j. Closer Holder Release Devices: ANSI A 156.15 (BHMA 321)
- k. Auxiliary Hardware: ANSI A 156.16 (BHMA 1201)
- l. Materials & Finishes: ANSI A 156.18 (BHMA 1301)
- m. continuous Geared Hinges: BHMA A156.26.

2.03 MATERIALS AND FABRICATION

- A. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- B. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Engineer. Manufacturer's identification will be permitted on rim of lock cylinders only.
- C. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A 156 series standard for each type hardware item and with ANSI A 156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- D. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- E. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
- F. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.
- G. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Authority's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.04 HINGES AND PIVOTS, GENERAL

- A. Standards: Comply with the following:
 - 1. Butts and Hinges: ANSI A8112, ANSI A156.1.
 - 2. Template Hinge Dimensions: ANSI A156.7.
 - 3. Self-closing Hinges and Pivots: ANSI A156.17.
 - 4. Pivots: ANSI A156.4.
 - 5. Continuous Geared Hinges: ANSI A156.26
- B. Quantity: Provide the following, unless otherwise indicated:
 - 1. Two Hinges: For doors with heights up to 60 inches.
 - 2. Three Hinges: For doors with heights 61 to 90 inches.
 - 3. Four Hinges: For doors with heights 91 to 120 inches.

4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

C. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches)	
		Standard Weight	Heavy Weight
32" x 84" x 1-3/4"	4-1/2"	0.134"	
36" x 84" x 1-3/4"	4-1/2"	0.134"	0.180"
42" x 90" x 1-3/4"	4-1/2"	0.134"	0.180"
48" x 120" x 1-3/4"	5"	0.146"	0.190"

D. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves)

E. Hinge Applications: Unless otherwise indicated, provide the following:

1. Exterior and Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Heavy-weight hinges for metal doors.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Stainless steel, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

G. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
2. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
 - a. Outswinging exterior doors.
 - b. Outswinging corridor doors with locks.
3. Raised Barrel: Offset both leaves to raise barrel off door jamb.
4. Corners: 1/4 inch radius.

H. All Leaf Hinges: Full Mortise Hinges, Five Knuckle, Ball Bearing.

I. Continuous Hinges: Geared, Concealed Leaf, Full Length of Door. Hinge material to be 14 gauge type 304 stainless steel, brushed satin finish (US32D). Continuous hinge to be Hager 790 series or approved equal.

J. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames. Finish screw heads to

match surface of hinges.

2.05 LOCK CYLINDERS AND KEYING

- A. General: Supplier shall meet with Authority to finalize keying requirements and obtain final instructions in writing.
- B. Existing System: Masterkey the locks to the Authority's existing system.
- C. Cylinders:
 - 1. Equip locks with cylinders and/or interchangeable-core pin tumbler inserts. Furnish only temporary cylinders or cores for construction, remove these when directed. Provide final cylinders or cores uncombined, the Authority will combine and install final units.
 - 2. All final cylinders to be BEST cylinders conforming to existing CTA cylinders. Provide uncombined cylinders or cores of the type so that the Authority can masterkey.
 - 3. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver as indicated.
 - 4. Temporary and final cylinders to be high-security, complying with performance requirements for Grade 1 cylinders as listed in ANSI/BHMA A156.5 and having been tested for pick and drill resistance requirements and are UL listed.
- D. Keys and Keying:
 - 1. Provide individual blank change keys for each lock which is noted below. Each key blank to be permanently inscribed with the notation "DO NOT DUPLICATE" and will be permanently inscribed with a number or lock that identifies cylinder manufacturer key symbol.
 - 2. Key Material: Provide blank keys of nickel silver only.
 - 3. Key Quantity: Furnish 3 blank change keys for each lock; 5 blank master keys for each master system; and 5 blank grandmaster keys for each grandmaster system.
 - a. Furnish one extra blank for each lock.
 - b. Deliver blank keys to the Authority's representative.
- E. Provide a key control system including envelopes, labels, tags with self-locking key clips, temporary markers, for the number of locks required for the project.

2.06 LOCKS, LATCHES AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
- B. Mortise Locks: Stainless Steel; conforming the ANSI/BHMA A156.13 (Series 1000); Grade 1 operation and security.
- C. Auxiliary Locks: (If required) Stainless Steel; conforming the ANSI/BHMA A156.5; Grade 1 operation and security.
- D. Lock Trim: Comply with the following:
 - 1. Lever: Wrought, forged, or cast.
 - 2. Knob: Wrought, forged, or cast.
 - 3. Escutcheon (Rose): Wrought, forged, or cast.

4. Dummy Trim: Match lever lock trim and escutcheons.
 5. Lockset Designs: Provide lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated.
- E. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, as follows:
1. Latchbolt Throw: Minimum 3/4 inch (19mm).
 2. Deadbolt Throw: Minimum 1 inch (25mm).
- F. Backset: 2-3/4 inches (70mm), unless otherwise indicated.
- G. Rabbeted Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.
- H. Provide knurled lever handles for doors leading to potentially hazardous areas as required by ADA.

2.07 CLOSERS AND DOOR CONTROL DEVICES

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's specifications for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.
1. Where parallel arms are indicated for closers, provide closer unit one size larger than specified for use with standard arms.
 2. Provide parallel arms for all overhead closers, except as otherwise indicated.
- B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A 117.1 provisions for door opening force and delayed action closing.
- C. Provide grey resilient parts for exposed bumpers.
- D. All closers to be surface mounted, modern type (covered) conforming to ANSI/BHMA 156.4., Grade 1
1. Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm.
 2. Mounting: Parallel arm.
 3. Type: Regular arm.
 4. Backcheck: Adjustable.
 5. Cover Material: Aluminum.
 6. Closing Power Adjustment: At least 50 percent more than minimum tested value.
- E. Power-Assist Closers: As specified in Section, Power Door Operators.
- F. Provide all-weather fluid.
- G. Where indicated, provide the following additional features to closer:
1. CNS for door "stop" feature of closer.
 2. H for "hold open" feature of closer.

2.08 EXIT DEVICES

- A. On all station exit doors, provide panic-type exit devices, with concealed vertical rod

device. Exit device to comply with ANSI A 156.3, Grade I. Panic bar to span across glass door lite. Finish shall be Type 304, Stainless Steel.

- B. Exit devices to have cylinder dogging feature, keyed alike to building system, which will keep the exit devices from latching, allowing free access in both directions at all times when the station is open. When this feature is activated, the exit device becomes a push bar from the interior and there is a latch-less pull from the exterior.
- C. When the station is closed and locked, both doors (active and inactive) of the pair can be locked into latch mode, allowing panic exit anytime from either door from the interior. The doors would then be inaccessible from the exterior, except by unlocking the active side of the pair of doors with a key.
- D. For those exterior entrance doors designated to also have automatic door hardware, provide the electric strike retraction feature for the exit devices.
- E. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."
- F. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- G. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- H. Outside Trim: Material and finish to match locksets, unless otherwise indicated.
 - 1. Match design for locksets and latches, unless otherwise indicated.
- I. Through Bolts: For exit devices and trim on metal doors.
- J. Concealed Vertical Rod Exit Devices: Comply with the following:
 - 1. Type: Type 6, narrow stile, Type 7, for wood doors, and Type 8, for metal doors.
 - 2. Actuating Bar: Cross bar.
 - 3. Material: Stainless steel.

- K. Electrified Exit Device Options: Types and functions indicated as follows:
1. Request-for-Exit Function: Signal initiated when push bar is actuated.
 2. Electric Latch Retraction: Remote signal activates continuous-duty solenoid that retracts latch.
- L. Alarmed Exit Devices: Alarm sounds when exit device activated. Signage in English and Brail: "EMERGENCY EXIT ONLY – ALARM WILL SOUND". Alarmed exit devices to be hard wired with battery back up. Alarm to be disarmed or reset by a key. Alarm to be 100 decibels. Horn for alarm to be remotely located at ceiling as directed by the Authority. Activation of the alarm shall also activate an alarm with indicator in the counsel located in the Customer Assistant's kiosk for the station. Exit device to have an indicator light indicating proper operation. Alarmed exit device to comply with NFPA 101 Life Safety Code, UL listed for Panic Exit Hardware (UL 305) and tested in accordance with ANSI A 156.3 Grade 1 Panic Hardware.

2.09 AUTOMATIC DOOR HARDWARE

- A. For entrance doors noted to be automatic or power assisted, for handicap accessibility, provide the following additional hardware:
1. Instead of the manual closer, provide and install a low energy pneumatic power closer. Closer to have a heavy duty cast iron cylinder with all-weather fluid; a large tandem air cylinder to allow the door to open slowly to 90 degrees; allowing manual operation or using the power of pressurized air to automatically open the door. Closer to be top jamb (push side) mounted, non-handed, non-sized.
 2. Provide and install a self-contained control box and air compressor. Location as indicated on drawings or as directed by engineer. Provide all required mounting accessories, pneumatic connections, and electrical connection. Control box/compressor to be capable of operating two doors.
 3. Provide and install (concealed) required pneumatic tubing. Make all required connections.
 4. Provide and surface mount two actuators for each automatic door. One actuator to be located at the interior and one actuator at the exterior. Locations as shown on drawings or as directed by engineers. Mounting height as required by code. Where indicated, provide and install a stainless steel bollard for mounting of the actuator. Provide all wiring and connections.
- B. Automatic door system, all hardware, and installation to conform to ADA, local codes, and ANSI A 156.19.

2.10 DOOR TRIM UNITS

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, mop plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screw.
- B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.
- C. Provide kickplates at both sides of door. Fabricate kick plates and mop plates not more than 1-1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x 8" high unless otherwise indicated. Metal plates shall be stainless steel, 0.050" (U.S. 16 ga.).
- D. Standards: Comply with the following:

1. Door Trim: ANSI A156.6.
2. Stops and Bumpers: ANSI A156.16.
3. Door Silencers: ANSI A156.16

E. Stops and Bumpers: BHMA Grade 1.

2.11 WEATHERSTRIPPING

A. Standard: Comply with ANSI A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide type, sizes and profiles shown or scheduled. Provide non-corrosive fasteners as specified by manufacturer for application indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke- control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on all smoke- and fire-rated doors requiring fire- label gasketing.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252. Where required by NFPA.

F. Gasketing Materials: Comply with ASTM D2000 and AAMA 701/702.

G. Replaceable Seal Strips: Provide only those unites where resilient or flexible seal strip is easily replaceable and readily available from manufacturers stock.

H. Weatherstripping at Jamb and Heads: Provide bumper-type resilient insert and metal retainer strips, surface-applied unless shown as mortised or semi-mortised, of metal, finish and resilient bumper material as indicated in hardware.

I. Weatherstripping at Door Bottoms: Provide threshold consisting of contact type resilient insert and metal housing of design and size shown; of metal, finish, and resilient seal strip indicated in hardware schedule.

J. Adjustable, Housed Perimeter Gasketing: Screw-adjustable gasket material held in place by metal housing; fastened to frame stop with screws.

1. Gasket Material: Polyurethane bulb or Vinyl bulb.
2. Housing Material: Stainless steel.

- K. Meeting Gasket double doors with not astragal or center post: Gasket material held in place by metal housing; mounted with screws.
1. Gasket Material: Neoprene bulb or Vinyl bulb.
 2. Housing Material: Stainless steel.
 3. Mounting: Mortised or Semi-mortised into edge of each door.

2.12 THRESHOLDS

- A. General: Except as otherwise indicated provide a threshold at every door, handicap accessible metal (stainless steel or aluminum) threshold unit of type, size and profile as shown or scheduled.
- B. Provide units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as scheduled.
- C. Saddle Thresholds for: Fluted top; type and base metal as follows:
1. Conforming to ANSI/BHMA 156.21, J52130 – Fluted top; Barrier free.
 2. Base Metal: Stainless steel.

2.13 LOCK GUARD

- A. To deter insertion of tools, picking, or forcing of latch at opening between door and frame for doors in public areas that open outward. Lock guard to be non-handed, suitable for mortise locks, have an offset that permits use on hollow metal installations and allow clearance for lip of lock strike. Lock guard to be of 16 gauge stainless steel, satin finish. Lock guard to be 1 ½" wide X 10" long.

2.14 FLUSH BOLTS

- A. Flush bolts where indicated for top and/or bottom of doors to be Ives (or equal) Series 257, 12" rod length, ½" square bolt head, ¾" throw. Concave if required. B26 D finish, Dull Chrome.
- B. Standards: Comply with the following:
1. Surface Bolts:
 2. Manual Flush Bolts: ANSI A156.16.
- C. Surface Bolts: ANSI A156.16., L54161 – Stainless steel, Grade 1.
- D. Flush Bolts: ANSI A156.16., L1408, 409, 410, 426 or 427 as appropriate – Stainless steel, Grade 1.
1. Flush Bolt Heads: Minimum of 1/2 inch diameter rods of brass, bronze, or stainless steel with minimum 12 inch long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
- E. Fire-Rated Surface Bolts: 8 inch steel bolt with 2 steel guides; minimum 1 inch throw; listed and labeled for fire-rated doors; with universal strike.
- F. Manual-Extension Flush Bolts: Fabricated from extruded brass or aluminum, with 12 inch rod actuated by flat lever; listed and labeled for fire-rated doors. Provide matching strike.
- G. Slide Flush Bolts: Cast brass, with rod actuated by slide. Provide matching strike.

- H. Strikes: Provide dust proof strikes at all thresholds and floors than engage bolts.

2.15 AUXILIARY ITEMS

- A. Stops: Provide each door with a convex, rubber wall stop or floor stop, with satin stainless steel base, similar as indicated in the schedule. Exterior and unusual door locations shall receive overhead stop integral with closer as indicated or required.
 - 1. Floor mounted dome stop: Ives 438 or approved equal.
 - 2. Wall mounted bumper: Ives 407 or approved equal.
- B. Push/Pull: As detailed 42" from floor to center of pull.

2.16 HARDWARE FINISHES

- A. Finish shall be satin stainless steel ANSI/BHMA A156.18 Finish Number 630 or US32D, unless noted or approved otherwise. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
- B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames
 - c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.
 4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
 5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."
- E. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- F. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI A 156.18 "Materials & Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount Hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the Authority.
- B. Install each hardware item in compliance with the manufacturer's instructions and specifications. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in the Division 09 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for doors in full bed of butyl-rubber or polyisobutylene mastic sealant.
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and specifications to the extent installation requirements are not otherwise indicated.
- G. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Authority's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Authority's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.
- F. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators. Refer to Division 01 Section, Closeout Procedures.

3.03 HARDWARE SCHEDULE

- A. Provide hardware for each door to comply with requirements indicated in this section. The following hardware sets as listed in this Schedule are for locations indicated on the drawings.
- B. Keying system per the Authority's requirements. Refer to Drawings for door handing and sizes. Provide size of hinges as specified above.

Set No. 1

TOILET, JANITOR CLOSET

- 1-1/2 pr. Butts, Hager BB1199-32D-NRP, 630
- 1* Lockset, Corbin Russwin ML 2257 CSM, 630, 1-5/32" cylinder keyed to No. 6 (or Russwin 981) key, "B" Master and Grandmaster, Best Mortise cylinder 1E74 C191 RP3 with construction core.
- 1 Closer, LCN 4111, Prime.
- 1 Kickplate 630, B4E.
- 1 Threshold, Pemko No. 2005 AS Alum.
- 1 set Weatherstripping, Zero No. 328 A, all around.
- 1 Stop, Ives No. 407 or 438, 630.
- 1 Overhead Heavy Duty Stop, Glynn-Johnson 90s Series.
- 1 set Door silencers, Glynn-Johnson No. SR64 or SR65.
- 1 Lock guard, Ives # 182S32D.

*Toilet shall receive in addition to the above, Falcon Lock, "OCCUPIED" Indicator Lock Cat. No. D 871.

Set No. 2

COMMUNICATION ROOM, AGENTS BOOTH

- 1-1/2 pr. Butts, Hager BB1199-32D-NRP, 630
- 1 Lockset, Russwin ML 2257 CSM, 630, with Best removable core cylinder, 1E74 C191 RP3 with construction core.
- 1 Closer, LCN 4111, 630.
- 1 Kickplate 630, B4E.
- 1 Threshold, Pemko 2005 AS Alum.
- 1 set Weatherstripping, Zero No. 328 A, all around.
- 1 Stop, Ives No. 407 or 438, 630.
- 1 Stop Overhead Heavy Duty, Glynn-Johnson 90s Series.
- 1 set Door silencers, Glynn-Johnson No. 64 or 65.
- 1 Lock guard, Ives No. 162S32D.

Set No. 3

ELECTRICAL ROOM, ELEVATOR MACHINE ROOM

- 1-1/2 pr. Butts, Hager BB1199-32D-NRP, 630
- 1 Lockset, Russwin ML 2257 CSM, 630, with Best removable core cylinder, 1E74 C191 RP3 with construction core, knurled handles for doors to hazardous areas per ADA.
- 1 Closer, LCN 4111, 630.
- 1 Kickplate 630 B4E.
- 1 Threshold, Pemko 2005 AS Alum.
- 1 set Weatherstripping, Zero No. 328 A, all around
- 1 Stop, Ives No. 407 or 438, 630.
- 1 Overhead Stop Heavy Duty, Glynn-Johnson 90S Series.
- 1 set Door silencers, Glynn-Johnson No. 64 or 65.
- 1 Lock guard, Ives No. 162S32D.

Set No. 5 (Set No. 4 not used)

STATION ENTRANCE DOORS

Metal and Glass; each pair shall receive:

- 1 Cylinder, 1-5/32", keyed to No. 6 (or Russwin 981) key, "B" Master and Grandmaster, Corbin Russwin or Best 1E 74 C181 RP3 with construction core.
- 2 Continuous Geared Hinge: Rotan 780-112HD.
- 2 Closers, LCN 4111H, 630.
- 1 Threshold, Pemko 2005 AS Alum.
- 1 set Weatherstripping Zero No. 328 all around.
- 2 Exit Devices, Von Duprin, concealed vertical rod, 9847 TL-CD (for lockable leaf) and 9847 NLOP (for dummy leaf).
- 2 Overhead Stops, Heavy Duty, Glynn-Johnson 90S Series.
- 2 Push/Pull, Hiawatha 200D X 523B, 32" x 15" plate one side, 12" pull other side, US 32D with tamperproof screws and cylinder holes.
- 1 Lock guard, Ives No. 162S32D.

Set No. 7 (Set No. 6 not used)

CLOSET

- 2 pr. Butts, Hager BB1199-32D-NRP, 630
- 1 Lock, Adams Rite MS 1851 S, 630, With 1 1/8" BS; key function, Best removable core cylinder, 1E74 C191 RP3 with construction core, knurled handles for doors to hazardous areas per ADA.
- 1 Closer, LCN 4111, Prime.
- 1 set Kickplates 630 B4E.
- 1 Threshold, Pemko 2005 AS Alum.
- 1 set Weatherstripping, Zero #328 A, all around
- 1 Flush bolt for inactive leaf
- 1 Stop, overhead heavy-duty stop (each leaf) Glynn-Johnson 90S Series. 630.
- 1 set Door silencers, Glynn-Johnson No. SR64 or SR65.
- 1 Lock guard, Ives No. 162S32D.

Set No. 10 (Sets No. 8 and 9 not used)

SECURITY GATE

- 1 Continuous Stainless Steel Hinge Hager 790-900, US32D.
- 1 Exit Device, Von Duprin, 9875EO, US32D. Drill 3 equally spaced weep holes in bottom of mechanism case (not push bar) at exterior installation.
- 1 Closer LCN 4114 MC.

END OF SECTION 08 71 00

SECTION 08 71 60
POWER DOOR OPERATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Power door operators for one-way swinging doors.

1.03 RELATED WORK

- A. Section 08 41 10, Aluminum Entrances and Framing
- B. Section 08 71 00, Door Hardware
- C. Division 26 Sections for electrical power and connections

1.04 REFERENCES

- A. BHMA A156.19 - Power Assist and Low Energy Power Operated Doors.
- B. ICC/ ANSI A117.1 – Current Edition – American National Standard Accessible and Usable Buildings and Facilities.
- C. ADAAG – Current Edition – Americans with Disabilities Act Architectural Guidelines, Accessibility Guidelines for Buildings and Facilities.

1.05 SUBMITTALS

- A. Product Data: For each door operator type required. Include manufacturer's standard details, fabrication methods, and published recommendations for each component of the door operating system required, and the following:
 - 1. Roughing-in diagrams.
 - 2. Certified performance reports.
 - 3. Installation instructions.
 - 4. Parts lists.
- B. Wiring Diagrams: Detail wiring for power operator, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For power door operators to include in the maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the product manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing operators

similar to those indicated for this Project and with a record of successful in-service performance.

- C. BHMA Standard: Provide power door operators that comply with applicable requirements of BHMA A156.19, "Power Assist and Low Energy Power Operated Doors."
- D. UL Standard: Provide power door operators that comply with UL 325.

1.07 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace components of the power door operator system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Faulty operation of operator or controls.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Warranty Period: 3 years from date of Substantial Completion of total project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering power door operators that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Electromechanical Operators for Swinging Doors:
 - a. Besam, Inc.
 - b. Horton Automatics.
 - c. LCN.
 - d. NT Dor-O-Matic.

2.02 GENERAL DOOR OPERATOR REQUIREMENTS

- A. Capacity: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Hinge Operation: For swinging doors, refer to Section 08710, Door Hardware to determine the type of hinge action to accommodate door operator action.
- C. Exposed Housing: Minimum 0.062-inch thick, extruded- or formed-aluminum cover with provisions for maintenance access. Provide with fasteners concealed when door is in closed position. Finish to match doors and frames. Size and material shall be compatible with all-glass entrance door top rails.
- D. Adjustment Features: Operators shall be fully adjustable. Provide adjustment for

opening, closing, and checking speeds, as well as length of time door remains open.

2.03 SWINGING DOOR OPERATORS

- A. Electromechanical Operators for Swinging Doors: Manufacturer's standard electromechanical unit with doors power opened and spring closed, with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, and with easy manual operation including spring closing with power off. Provide operator action as indicated and mounting as follows:
 - 1. Operator Mounting Type: See hardware specifications
 - 2. Power-Assisted and Low-Energy Operators: Provide power-assisted and low-energy operators meeting requirements of BHMA A156.19 and ADA's "Accessibility Guidelines for Buildings and Facilities (ADAAG)," Appendix B, Article 4.13.12, "Automatic Doors and Power-Assisted Doors."
 - 3. Power-Assisted Closing: Provide power-assisted spring closing for overcoming wind and static pressures.

2.04 OPERATOR CONTROL SYSTEMS

- A. Freestanding Post with Push-Plate Switch: Manufacturer's standard semiflush, post-mounted, door-control switch plate for operation by touch of elbow by occupants familiar with door operating system.
- B. Finish: Stainless Steel, non-directional satin No. 4 post.
- C. Mounting: As specified in Section 08710, Door Hardware.

PART 3 EXECUTION

3.01 PREPARATION

- A. Templates and Diagrams: Furnish templates, diagrams, and other data to fabricators and installers of related work as necessary for coordinating power door operator installation.

3.02 INSTALLATION

- A. General: Install complete power door operator system according to manufacturer's written instructions, including controls, control wiring, and remote power units.
 - 1. Refer to Division 26 Sections for power connection.
- B. Set tracks, header assemblies, operating brackets, rails, and guides level and true to location with adequate anchorage for permanent support.

3.03 ADJUSTING

- A. After repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles), readjust door operators and controls for optimum operating condition, safety, and weathertight closure. Lubricate hardware, operating equipment, and other moving parts.

END OF SECTION 08 71 60

SECTION 08 80 00
GLASS GLAZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 01 Specification sections, apply to this section.

1.02 SUMMARY

- A. Extent of glass and glazing work is indicated on drawings and schedules.
- B. Types of work include glass and glazing for:
1. Doors and windows.
 2. Windbreaks.
 3. Curtain walls and entrances.
 4. Elevator enclosures.
 5. Kiosk glazing.
 6. Skylite or roof glazing.
- C. Provide and install a sacrificial film on both sides of all glazing except skylight and roof glazing.

1.03 RELATED DOCUMENTS

- A. The following sections contain requirements that relate to this section:
1. Division 05 Section "Perforated Metal Panels".
 2. Division 07 Section "Joint Sealers".
 3. Division 13 Section "Kiosk".

1.04 REFERENCES

- A. ASTM C509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
- B. ASTM C864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- C. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- D. ASTM C1021 – Standard Practice for Laboratories Engaged in the Testing of Building Sealants.
- E. ASTM C1036 – Standard Specification for Flat Glass.
- F. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- G. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass.
- H. ASTM C1330 – Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

- I. ASTM D256 – Determining the Izod Pendulum Impact Resistance of Plastics.
- J. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- K. ASTM D671 – Standard Test Method for Flexural Fatigue of Plastics by Constant-Amplitude of Force.
- L. ASTM D785 -Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
- M. ASTM D1003 -Haze and Luminous Transmittance of Transparent Plastics.
- N. ASTM D1044 – Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
- O. ASTM E548 – Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
- P. ASTM E773 – Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units.
- Q. ASTM E774 – Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
- R. ASTM E1300 -Standard Practice for Determining Load Resistance of Glass in Buildings.
- S. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIRA7, "Sloped Glazing Guidelines."
 - 3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

1.05 DEFINITIONS

- A. Interlayer: Space between lites of a laminated-glass unit that is made of Polyvinyl Butyral Interlayer or other approved material.
- B. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- C. Deterioration of Polycarbonate Sheet Glazing: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than breakage and practices for maintaining and cleaning the material contrary to manufacturer's written instructions. Defects include discoloration, perceptible visual distortion, materially

obstructing vision through glazing, and blemishes exceeding those allowed by referenced polycarbonate sheet glazing standard.

- D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.

1.06 PERFORMANCE REQUIREMENTS

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in construction.
- B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300 and to withstand all applicable loading requirements, according to the following requirements:
 - a. Specified Design Wind Loads: 20 psf.
 - b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads".
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
 - 1) Load Duration: 30 days.
 - e. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thicknesses required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm) whichever is less.
 - 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
- C. Heat-Treated Float Glass: ASTM C1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and conditioned indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise noted.
 2. Provide Kind HS (heat-strengthened) float glass on other than attic stock.

- D. Laminated Glass: ASTM C1172, and complying with other requirements specified and with the following:
1. Interlayer: Polyvinyl Butyral of minimum 6mm thickness with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
 2. Lamination Process: Laminate lites in autoclave with heat plus pressure. Fabricate laminated glass to produce glass free of foreign substances and air or gas pockets.
- E. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Size polycarbonate glazing panels to fit openings specified, allowing for expansion and contraction over the temperature range noted, per the manufacturer's printed instructions.
1. Temperature Change (Range): 120 degrees Fahrenheit (67 degrees Celsius), ambient; 180 degrees Fahrenheit (100 degrees Celsius), material surfaces.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For laminated-glass lites, properties are based on products of construction indicated.
 2. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal ½ inch wide interspace.
 2. Center-of Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq.ft. x h x degrees Fahrenheit (W/sq.m x K).
 3. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
 4. Solar Optical Properties: NFRC 300.
- G. Glazing Design: Glazing thicknesses indicated, if any, are minimums. See drawings and/or schedules for thicknesses for specific applications and locations. Also, manufacturer shall provide the proper thickness for each type of glazing material based on the specific application, size of lite, wind and other loads, vibration, local codes and other design factors.
- H. Polycarbonate Design: Sheet polycarbonate glazing panels are to be provided in thicknesses indicated, but not less than thicknesses and in strengths required to meet or exceed the following criteria:
1. Physical Properties:
 - a. Light Transmission: Minimum 88 percent, for clear glass, as tested under ASTM D1003.
 - b. Rockwell Hardness: Values of M70, R118 as tested under ASTM D785.
 - c. Flexural Endurance: Minimum 1000 psi, at 1800 cycles/min., at 73 degrees Fahrenheit, 50 percent RH, per ASTM D671.
 - d. Impact Strength: 12-16 ft-lbs/in., up to 125 mils, notched, as measured under ASTM D256, method A.
 - e. Flame Spread: Less than one (1) inch horizontal burn as tested under ASTM D635.

- f. Abrasion Resistance: Values to be measured under ASTM D1044 (Z26.1) to yield no more than 4 percent haze with 100 Taber Abrasion Cycles (CS10F).
2. Panel Sizes: Panels to be provided in single sheets where shown in steel glazing frames, i.e., no joints or breaks within individual panels unless specifically indicated.
3. Panel Surface Treatments: Provide a combined abrasion/UV-resistant surface treatment such that the manufacturer will provide a 10 year limited warranty against yellowing, breakage, loss of light transmission and coating failure.

1.07 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.
- B. Samples: Submit, for verification purposes, 12 inch square samples of each type of glazing and interlayer material indicated, and 12 inch long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color. Include a sample of each laminated glass product with patterned interlayer as indicated, with opaque interlayer as indicated, and a sample of the clear glass sheet in thickness indicated.
 1. Provide samples of clear, tints, opaque colors, and frit patterns for interlayer material for Authority's selection and approval for each type of interlayer material to be used.
- C. Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.
- D. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including specifications for primers and substrate preparation needed to obtain adhesion.
- E. Schedule of types, sizes, thicknesses, and installation methods for each size opening and location; using same designations indicated on drawings for glazed openings; and based on actual field verified dimensions and conditions.
- F. Qualification Data for Contractors: Demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses.
- G. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:
 1. Laminated glass-each of 3 panel types indicated.
 2. Polycarbonate sheet glazing.
 3. Insulating glazing.

- H. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- I. SWRI Validation Certificate: For each elastomeric glazing sealant specified to be validated by SWRI's Sealant Validation Program.
- J. Warranties: Special warranties specified in this Section.

1.08 QUALITY ASSURANCE

- A. Glazing Standards: Comply with specifications of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- C. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- D. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.
- E. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- F. Product Testing: Obtain test results for product test reports in "Submittals" Article from a qualified testing agency based on testing products.
 - 1. Glass Testing Subcontractor Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E548.
 - 2. Contractor shall provide a testing subcontractor, as defined in the Division 01 section, "Reference Standards and Definitions", to perform glazing testing and monitoring thereof. Such testing and monitoring shall be performed in accordance with the Division 1 section, "Testing and Inspection Service".
- G. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.

2. Test elastomeric glazing sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- H. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.
1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - a. Perform tests under normal environmental conditions replicating those that will exist during installation
 2. Submit not fewer than nine pieces of each type and finish of framing members and each type, class, kind, condition, and form of glazing as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- I. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
1. Subject to compliance with requirements, permanently mark safety glass, as applicable, with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.
- K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 50, Project Meetings.
- 1.09 DELIVERY, STORAGE, AND HANDLING
- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent scratching and edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.
- 1.10 PROJECT CONDITIONS
- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer

or when joint substrates are wet due to rain, frost, condensation or other causes.

1. Install liquid sealants at ambient and substrate temperatures above 40 degrees Fahrenheit (4.4 degrees Celsius).
2. Do not install polycarbonate units when ambient and substrate conditions are above 80 degrees Fahrenheit or below 40 degrees Fahrenheit.

1.11 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Authority may have under the Contract Documents.
- B. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of Final Acceptance.
- C. Manufacturer's Special Project Warranty on Laminated Glass: Provide written warranty signed by manufacturer of laminated glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within ten (10) years after date of Final Acceptance, replacements for those laminated glass units which develop manufacturing defects. Manufacturing defects are defined as edge separation, delamination, air pockets, or other imperfections which materially obstructs vision through the glass.
- D. Manufacturer's Special Warranty on Polycarbonate Sheet: Written warranty, made out to the Authority and signed by manufacturer agreeing to furnish replacements for polycarbonate sheet units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, or that yellow greater than index 7.5, within specified warranty period of 10 years from the date of Final acceptance.
- E. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturing agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period of 10 years from date of Final Acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

1. Heat-Treated Glass:

- a. AFG Industries, Inc.
- b. Cardinal IG.
- c. Environmental Glass Products.
- d. Falconer Glass Industries.
- e. Ford Glass Division.
- f. Guardian Industries Corp.
- g. Hordis Brothers, Inc.
- h. LOF Glass, Inc.
- i. PPG Industries, Inc.
- j. Viracon, Inc.

2. Manufacturers of Laminated Glass:

- a. Advanced Coating Technology.
- b. AFG Industries, Inc.
- c. Environmental Glass Products.
- d. Falconer Glass Industries.
- e. Ford Glass Division.
- f. Guardian Industries Corp.
- g. HGP & Affiliates, Inc.
- h. PPG Industries, Inc.
- i. Tempglass
- j. Viracon, Inc.

3. Manufacturers of glass clad polycarbonate laminate:

- a. Globe Amerada Glass.
- b. Guardian Industries.
- c. Viracon, Inc.

4. Manufacturers of patterned laminated glass:

- a. Sumiglass by American Glassmith, Inc.

5. Manufacturers of fire-rated glazing products:

- a. FireLite Plus by Nippon Electric Glass Co., Ltd. distributed by Technical Glass Products.
- b. PyroStop distributed by Technical Glass Products.
- c. SuperLite II by SAFTI Div., O'Keeffe's Inc.
- d. Pyrovue Commercial by Advanced Glass Systems Corp.

6. Manufacturers of sacrificial film products:
 - a. MADICO, Inc.
 - b. Approved equal.

2.02 GLASS PRODUCTS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.
- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with specifications of glass manufacturer. Provide thicknesses indicated and/or as specified by glass manufacturer for application indicated and/or as required by code for actual conditions, sizes, and wind loads.

2.03 PRIMARY GLASS PRODUCTS

- A. Clear Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality Q3 (glazing select).
- B. Total thickness of clear float glass to be as indicated on drawings, to be as indicated on schedule at the end of this section, to meet design criteria, to meet standards indicated, and/ or to meet applicable codes; but not less than 3/8".

2.04 HEAT-TREATED (TEMPERED) GLASS PRODUCTS

- A. Heat-Treated or Tempered Glass: ASTM C1048; manufacture heat-treated glass by vertical (tong-held) or horizontal (roller hearth) process, at manufacturer's option, except provide horizontal process where indicated as "tongless" or "free of tong marks".
 1. Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind FT (fully tempered) where indicated.
- B. Total thickness of tempered glass to be as indicated on drawings, to be as indicated on schedule at the end of this section, to meet design criteria, to meet standards indicated, and/ or to meet applicable codes; but not less than 1/4".

2.05 LAMINATED GLASS PRODUCTS

- A. Laminated Glass Products: Comply with ASTM C1172 for kinds of laminated glass indicated and other requirements specified. Refer to primary and heat-treated glass requirements relating to properties of glass products comprising laminated glass products.
- B. Glass: Two outer glass panels of clear float glass (unless specified otherwise).
- C. Interlayer: Interlayer material as indicated below, in clear or with frit pattern as noted, and of thickness indicated, with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating and installation.

1. Interlayer Material: Polyvinyl Butyral sheet.
 2. Color and pattern of plastic interlayer: Clear or frit as specified.
 3. Frit (where pattern is specified): Clear (or tinted if specified) interlayer of thickness as required for the assembly to comply as a Type II safety glass material) to have square frit printed pattern, 11/16" squares on 1-1/4" spacing, aligned in a grid vertically and horizontally. Squares are the frit rather than the grid.
- D. The assembly is created by laminating the interlayer, two layers of adhesive and two glass panels; the entire assembly is then permanently bonded. The assembly shall comply as a safety laminated product meeting industry standard ANSI Z-97. 1-1984 and the Consumer Product Safety Commission Federal standard 16 CFR 1201, Category I and II. The assembly shall be both weather and ultraviolet radiation resistant.
- E. Products: Subject to compliance with requirements, provide one of the following:
1. Polyvinyl Butyral Interlayer:
 - a. Saflex, Monsanto Co.
 - b. Butacite, E.I. du Pont de Nemours & Co., Inc.
- F. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:
1. Laminate clear float glass lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.
- G. Total thickness of laminated glass to be as indicated on drawings, to be as indicated on schedule at the end of this section, to meet design criteria, to meet standards indicated, and/ or to meet applicable codes; but not less than 3/8"+ (Inner and outer layer of 3/16" clear float glass bonded to interlayer of 0.06" Polyvinyl Butyral).

2.06 FIRE RATED ASSEMBLIES

- A. Laminated product in the form of two lites of clear safety glazing (heat treated, tempered) with a intumescent interlayer, including a clear, fully transparent, heat-absorbing gel. Thicknesses of glazing and interlayer as required for specific application, size of lite, as required by manufacturer, as required by code, and as required to obtain required fire-rating. Frame for fire-rated assembly to be as required to maintain required fire rating.

2.07 ATTACK RESISTANT GLAZING

- A. Attack Resistant glass-clad polycarbonate laminate assembly to consist of the following:
1. 9/16 inch (.5625 inch) overall thickness consisting of:
 - a. 1/8 inch thick clear, chemically strengthened glass.
 - b. 0.050 inch clear Urethane interlayer.
 - c. 1/4 inch clear polycarbonate interlayer.
 - d. 0.50 inch clear Urethane interlayer.
 - e. 1/8 inch thick clear, chemically strengthened glass.
- B. Attack Resistant assembly to be certified to meet the following tests:
1. Weatherability Tests: Meets ANSI Z.26.1-1977 and Z.26.1a-1983 and ASTM E773 and E774.

2. Clear Light Transmittance: 76 percent visible.
 3. Attack Resistance: Tested and certified by H.P. White Laboratories to meet Level I Forced Entry.
 4. Ballistic Protection: Tested by H.P. White Laboratories to meet Level A Ballistics Assault, 0.38 Special Handgun; 3 shots in an 8 inch circle, 158 grain lead, 20 feet. Results: Spall; no penetration.
- C. Provide single responsibility for all phases of manufacturing, from the chemical strengthening of the raw glass through the final lamination.
- D. Manufacturer and/or trade name resistant glazing to be one of the following:
1. "Secur-Tem + Poly" as manufactured by Globe/ Aemeroda Glass Co.
 2. "Glass-Clad No. 31554 as manufactured by Guardian Industries.
 3. "Guard-View 200" as manufactured by Viracon.
 4. Approved equal.

2.08 POLYCARBONATE SHEET GLAZING

- A. Where indicated on the drawings, provide and install polycarbonate glazing.
1. Thickness: 1/4 inch nominal thickness (0.236 inch actual) unless noted otherwise.
 2. Type: With UV and abrasion or mar-resistant coating on both sides similar to GE Lexan "Margard" MR-10, and (unless noted otherwise) with "HPW Nu-View" 0.10" thick laminate on both sides, or approved equals. Laminate and adhesives to be formulated for exterior applications. Laminate may be in lieu of scarficial film upon approval of the Authority.
- B. Polycarbonate shall be glazed using neoprene or polyvinyl chloride "PVC" gaskets as recommended by polycarbonate manufacturer and approved.
- C. Polycarbonate shall be guaranteed against breakage, coating failure, increased haze, excessive yellowing, and loss of light transmission for a period of 10 years. Polycarbonate failing within that period shall be replaced at no cost.
- D. Polycarbonate glazing shall be pre-sized and fitted to allow for thermal expansion and contraction of the glazing material. Follow manufacturer's recommendations for handling and installing the polycarbonate.

2.09 INSULATING-GLASS UNITS

- A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 774 for Class CBA units.
- B. Glass Type: Provide Kind FT (fully tempered) safety glass for both lites unless indicated otherwise.
- C. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in schedule or on drawings and as required for size and application of glass lite and wind and other loads. Minimum 25 mm overall and 6.0 mm each lite.
- D. Interspace Content: Air.
- E. Sealing System: Manufacturer's standard sealants.

F. Spacer Material: Aluminum with mill finish.

2.10 SACRIFICIAL FILM FOR WINDOW GLAZING VANDAL PROTECTION

- A. Provide and install a sacrificial film on both sides of all glazing for vandal protection unless shown or noted otherwise. Sacrificial film not required on skylights or roof glazing.
- B. The sacrificial protective film on each side shall be one layer of Polyethylene Terathalate (PET), each layer being 2 mils thick. There shall be an acrylic pressure sensitive adhesive on the back of the film, protected by a peel-off release liner, for installation to the glass.
- C. The protective film and adhesive must be formulated and approved for exterior applications.
- D. The sacrificial protective film and adhesive shall be as manufactured by the following:
1. MADICO, Inc.
 - a. Product Number LCL-600-XSRG for film applied to glass (laminated, tempered, float, etc.)
 - b. Product Number LCL-600-BFXSR for film applied to polycarbonate.
- E. The films must be compatible with the existing application solutions presently used by the Authority and removable by peeling off.
1. The application solutions shall be non-toxic and contain no chemical within the formulation which is a suspected human carcinogen. The application solutions currently approved and used by the Authority are as follows:
 - a. Product number 3901249 available through Graffiti Removal, Inc., Huntington Beach, CA.
 - b. Product Number 4608 available through Midwest Marketing, Peoria, IL.
- F. Other manufacturers of films and applications solutions equal to the specified film and solutions must be submitted to the Authority for written approvals prior to bidding. Provide the Authority with certified test reports, specifications, installation/removal instructions, Material Safety Data Sheet, and samples of the proposed film and solution to demonstrate that it is equal to the specified film and solution and complies with all requirements set forth herein.
1. Samples that are judged by the Authority to be difficult to install or remove when compared to approved sacrificial protective film and application solution, or fail to function under normal operating conditions when tested in service shall be rejected.
- G. Sacrificial film products shall meet or exceed the required results of the following ANSI/SAE Z26.1 tests:
1. Test 3, Humidity Test
 2. Test 15, Optical Deviation and Visibility Test.
 3. Test 17, Abrasion Resistance (Glass-Plastics)
 4. Test 19, Chemical Resistance (Non-stressed)
 5. Test 28, Resistance to temperature change.
- H. The sacrificial film products shall also meet the following performance requirements:

1. Physical Properties:
 Average Tensile Strength: Per ASTM D882 25,000 psi
 Average Break Strength: Per ASTM D882 150 lbs./in. (width)
 Adhesive Type: Acrylic Pressure Sensitive
- Average Peel Strength (mounted):
 Per ASTM D903
- For film to mounted glass 5 to 6 lbs./in. (of width)
- For film mounted to plastic glazing 2.5 to 3.5 lbs./in. (of width)

2. Solar optical properties – The sacrificial film shall meet or exceed the following solar optical properties:

Total Solar Energy;	
Average Percent Transmitted	79
Average Percent Reflected	10
Average percent Absorbed	11
Visible Light (Daylight): Average Percent Transmitted	83
Average Percent Reflected	10
"U" Factor:	
Median	1.08
Design	1.12
Percent of Ultraviolet Light Rejected	99
Shading Coefficient:	0.93
Percent Total Solar Energy	19

- I. Flame Spread and Smoke Developed: The sacrificial film shall meet or exceed a Class "A: Interior Wall and Ceiling Finish Classification as outlined in the National Fire Protection Association (NFPA) Life Safety Code 101, Section 6-5-3, when mounted to the appropriate substrate (i.e. glass) and tested and calculated per either NFPA 255 or ASTM E 84.

Class "A" Classification is as follows:
 Flame Spread 0-25
 Smoke Developed 0-450

- J. The sacrificial film must be able to be readily removed or peeled off by the Authority's personnel when damaged. A replacement film must be able to be installed by the Authority's personnel. As a part of this Contract, provide enough replacement material, in proper widths and for proper application (glass or plastic) to replace all the film used on this project at least once. Additional film must be available for purchase by the Authority for future replacements. As a part of this contract, provide all required equipment,

supplies, and installation and removal instructions required for the Authority's personnel to perform all removal and replacement operations.

2.11 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated and complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, interlayer of laminated glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 2. Suitability: Comply with specifications of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
 3. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by the Authority from manufacturer's standard colors.
- B. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for Type, Grade, Class and Uses.
1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C920 for uses indicated.
- C. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to uses indicated, O.
- D. Subject to compliance with requirements, glazing sealants which may be incorporated in the work include, but are not limited to, the following:
1. One-Part Acid-Curing Silicone Glazing Sealant:
 - a. "Chem-Calk 1200"; Bostik Construction Products Div.
 - b. "Dow Corning 795"; Dow Corning Corp.
 - c. "SCS 1200"; General Electric Corp.
 - d. "863"; Pecora Corp.
 - e. "Rhodorsil 3B"; Rhone-Poulenc Inc.
 - f. "Omniglaze"; Sonneborn Building Products Div.; ChemRex, Inc.
 - g. "Proglaze"; Tremco.
- E. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

2.12 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.13 GLAZING GASKETS

- A. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material indicated below, complying with ASTM C864, of profile and hardness required to maintain watertight seal:
 1. Neoprene, ASTM C864.
 2. EPDM, ASTM C864.
 3. Thermoplastic polyolefin rubber.
 4. Any material indicated above.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C509, Type II, black; and of profile and hardness required to maintain watertight seal:
 1. Neoprene.
 2. EPDM.
- C. Subject to compliance with requirements, manufacturers offering preformed gaskets which may be incorporated in the work include, but are not limited to, the following:
 1. D. S. Brown Co.
 2. Maloney Precision Products Co.
 3. Tremco.

2.14 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated.
- B. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- C. Cleaners, Primers and Sealers: Type specified by sealant or gasket manufacturer.
- D. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- E. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness specified by glass manufacturer to maintain glass lites in place for installation indicated.
- F. Edge Blocks: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness specified by glass manufacturer to maintain glass lites in place for installation indicated.
- G. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.
- H. Cylinder Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.15 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Pre-Installation Meeting: At Contractor's direction, Glazier, sealant and gasket manufacturers' technical representatives, glass framing erector and other trades whose work affects glass and glazing shall meet at project site to review procedures and time schedule proposed for glazing and coordination with other work.
- B. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.03 INSTALLATION OF SACRIFICIAL FILM FOR WINDOW GLAZING VANDAL PROTECTION.

- A. All glazing (glass and plastic) shall have installed on both sides a sacrificial film to protect the glazing. Film to be of such a type and installed in such a manner so that it may be readily removed and a new replacement film installed by the Authority's personnel. Install the initial film under proper atmospheric condition on clean surfaces. Installation shall be without bubbles, cuts, tears, bulges, wrinkles or other imperfections. Film shall be one piece without seams or overlaps. Do not install on wet or dirty surfaces. Follow film manufacturer's directions and recommendations for installation, including environmental and temperature range.
- B. Film shall be warrantied for one year against delaminating, yellowing or other defects in materials or workmanship. Defective film or installations shall be replaced at no cost to the Authority.
- C. Film shall be installed in the factory on both sides of the glazing so that it will end at the glazing gasket and the film can be removed without cutting or removing the glazing from the frame.

3.04 GLAZING, GENERAL

- A. Comply with combined printed specifications of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by manufacturers for installing lites.

- G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Remove temporary protective coating from polycarbonate, clean lite and assemble glazing unit with perforated metal as indicated on both sides. Glaze metal/polycarbonate/metal assembly into frames, with gaskets as indicated.

3.5 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening
- C. Do not remove release paper from tape until just before each glazing unit is installed.
- D. Apply heel bead of elastomeric sealant.
- E. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- F. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.06 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

1. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
2. Miter cut wedge-shaped gaskets at corners and install gaskets in manner specified by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant specified by gasket manufacturer.

3.07 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, in between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
- C. Provide compressible filler rods or equivalent back-up material, as specified by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated
- D. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- E. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

3.08 BUTT JOINT GLAZING

- A. Where indicated, fill butt joint between glazing with sealant. Provide blocking at vertical mullions to maintain joint dimensions.

3.09 PROTECTION AND CLEANING

- A. Protect exterior glazing from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glazing. Do not apply markers to surfaces of glazing. Remove nonpermanent labels and clean surfaces.
- B. Protect glazing from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method specified by glazing manufacturer.
- C. Examine glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method specified by glass manufacturer.
- D. Remove and replace glazing which is broken, chipped, cracked, scratched, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash any glazing exposed during construction activities on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial

completion in each area of project. Wash glazing by method specified by glazing manufacturer.

- F. Remove any protective cover over sacrificial film and/or glazing just before Substantial Completion.

3.10 GLAZING SCHEDULE

- A. LAMINATED GLASS LG-1: Where glass of this designation is indicated, provided glass lites complying with the following.

1. Top Lite: Type I (transparent glass, flat, float) glass.
 - a. Class 1 (clear).
 - b. Thickness: 3/16" (nominal).
2. Bottom Lite: Type I (transparent glass, flat) float glass.
 - a. Class 1 (clear).
 - b. Thickness: 3/16" (nominal).
3. Plastic Interlayer: 0.060 inch thick.
 - a. Interlayer Color: Clear; or
 - b. Interlayer Color: Frit pattern as noted in this section and as selected.
4. Laminated glass assembly to be protected both sides with sacrificial film.

- B. POLYCARBONATE SHEET: Where glazing of this designation is indicated, provide polycarbonate sheet units complying with the following:

1. Products: Provide products by one of the following manufacturers:
 - a. General Electric ("Lexan" MR10).
 - b. Polygal ("MonoGal", as applicable)
 - c. Other domestically-manufactured polycarbonate sheet product meeting all applicable criteria in this Section.
2. Overall Unit Thickness and Thickness of Each Lite: 1/4" (0.236").
3. Physical Properties: See 1.04 (C01.).
4. Polycarbonate sheet to be protected both sides with sacrificial film.

3.11 GLAZING SEALANT SCHEDULE

- A. Medium-Modulus Neutral-Curing Silicone Glazing Sealant GS-1: Where glazing sealants of this designation are indicated, provide products complying with the following.
1. Products provide one of the following:
 - a. 756 H.P; Dow Corning.
 - b. Silglaze II; GE Silicones.
 - c. 895; Pecora Corporation.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class 25.
 4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
 5. Use Related to Exposure: NT (nontraffic).

END OF SECTION 08 80 00

SECTION 08 90 00
TRANSLUCENT CANOPY SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes framed assemblies glazed with multi-walled (structured) polycarbonate panels as follows:
1. Building roof and canopies – see drawings for full extent of roof and canopies
 2. Building wall panels – see drawings for full extent of wall panels
 3. Manufacturer standard sheet metal flashings and closures.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 5 Section “Structural Steel for steel framing that supports structured polycarbonate panel assemblies.
 2. Division 7 Section “Sheet Metal Flashing and Trim” for related metal flashings and flashing material requirements.
 3. Division 7 Section “Joint Sealers” for sealants installed at perimeters of assemblies

1.03 REFERENCES

- A. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- B. ASTM D1929 – Ignition Temperature of Plastics.
- C. ASTM D2843 – Density of Smoke.
- D. ASTM E84 – Surface Burning Characteristics of Building Materials.
- E. ASTM D2244 – Color Changes
- F. ASTM D1003 – Losses in Light Transmission

1.04 DESIGN REQUIREMENTS

- A. Basic Wind Speed: 90 mph
- B. Wind Exposure Category: B.
- C. Wind, Snow and Concentrated Loads on Canopy Assemblies as indicated on Structural Drawings.
1. Transit Maintenance Worker roof canopy live load:
300lb point load (foot step) applied to any point on the Canopy Assembly, including the polycarbonate panel.
- D. Roof Assemblies: Class A per ASTM E108 or UL 790

- E. Maximum Allowable Deflection of Overhead Canopy Assemblies: $L/180$ of clear span for each assembly component.
 - 1. Combined Maximum Deflection: 1-inch (Verify).
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- G. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural Loads.
 - 2. Live loads – wind, snow and maintenance worker point load.
 - 3. Thermal Movements.
 - 4. Movements of supporting structure.
- H. Failure includes the following:
 - 1. Deflection exceeding specified limits.
 - 2. Water leakage.
 - 3. Thermal stresses transferred to supporting structure.
 - 4. Noise or vibration created by wind, thermal and structural movements.
 - 5. Loosening or weakening of fasteners, attachments and other components.
 - 6. Color changes or discoloration beyond limits of ASTM requirements.
 - 7. Loss of light transmission beyond limits of ASTM requirements.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for materials, components, fabrication, finish and installation instructions. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for assemblies.
- B. Samples for Verification: 12 inch square samples of each type of glazing and other material indicated, and 12 inch long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.
- C. Fabrication Sample: Of each framing intersection (interior and perimeter) made from 12" lengths of full-sized components and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Structured polycarbonate panels.
 - 5. Flashing and drainage.
- D. Shop Drawings: For assemblies, including plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate dimensions, tolerances, profiles, anchorage, connections, fasteners, hardware, provisions for expansion and contraction, drainage, flashing, finish, and attachments to supports of glazing, framing and options.

2. Provide engineering and drafting of Production Documents (Shop Drawings) including structural calculations of the entire structured polycarbonate panel system.
 3. Provide Shop Drawings signed and sealed by a licensed State of Illinois Structural Engineer stating compliance with structural design requirements.
- E. Certificate: Submit certificates from respective manufacturers attesting that materials furnished for project comply with requirements.
- F. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that materials have been tested for compatibility and adhesion with sealants and interpreting test results relative to material performance, including specifications for primers and substrate preparation needed to obtain adhesion.
- G. Qualification Data for Contractors: Demonstrate installation contractor capabilities and experience. Include lists of completed projects with project names and addresses.
- H. Product Test Reports: From a qualified testing agency indicating the products comply with requirements, based on comprehensive testing of current products. Provide testing data asserting that the assemblies comply with test performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies:
1. Flame and smoke testing.
 2. Wind load testing.
 3. Water penetration testing.
 4. Stabilization of color and transparency testing
- I. Performance Testing
1. Provide testing data asserting that the assemblies comply with test performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies with regards to wind load, water penetration,
- J. Preconstruction Adhesion and Compatibility Test Report:
1. From sealant manufacturer indicating glazing sealants were tested for adhesion to substrates and for compatibility.
- K. Maintenance Data: For assemblies to include in maintenance manuals.
- L. Warranties: Warranties and Special Warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Continuously engaged in translucent insulated daylighting manufacturing with a minimum of ten years of experience.
2. Able to demonstrate successful performance on comparable projects.
3. Responsible for all components.

B. Installer Qualifications:

1. Entity capable of assuming engineering responsibility, capable of performing work of this Section, and who is acceptable to manufacturer

C. Testing Agency Qualifications:

1. An independent agency qualified according to ASTM E699 for testing required.

D. Product Testing: Obtain test results for product test reports indicated in "Submittals" Article.

1. Contractor shall provide a testing subcontractor, as defined in the Division 01 Section, "Reference Standards and Definitions", to perform glazing testing and monitoring thereof.

E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E699.
2. Test elastomeric glazing sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - a. Perform tests under normal environmental conditions replicating those that will exist during installation
2. Submit not fewer than nine pieces of each type and finish of framing members and each type, class, kind, condition, and form of glazing as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
 - G. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
 - H. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - I. Pre-installation Conference: Conduct conference at Project site.
- 1.07 DELIVERY, STORAGE, AND HANDLING
- A. Protect materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent scratching and damage from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.
 - B. Deliver Materials to site in manufacturer's original, unopened containers and packaging with labels clearly identifying product name, manufacturer and location of installation.
- 1.08 PROJECT CONDITIONS
- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.
 1. Install liquid sealants at ambient and substrate temperatures above 40 degrees Fahrenheit
 2. Do not install polycarbonate units when ambient and substrate conditions are above 80 degrees Fahrenheit or below 40 degrees Fahrenheit.
 - B. Field Measurements: Indicate measurements on Shop Drawings.
- 1.09 WARRANTY
- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Authority may have under the Contract Documents.
 - B. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of Final Acceptance.
 - C. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - c. Water leakage.
 - d. Thermal stresses transferred to supporting structure.
 - e. Noise or vibration created by wind, thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments and other components
 2. Warranty Period: Ten years from date of Substantial Completion.
- D. Manufacturer's Special Warranty on Polycarbonate Sheet: Written warranty, made out to the Authority and signed by manufacturer agreeing to furnish replacements for polycarbonate sheet units that deteriorate (as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site), break or develop defects from normal use that are attributed to manufacturing or installation process and not to practices for maintaining and cleaning products contrary to manufacturer's written instructions.
1. Defects include, but are not limited to, the following:

Delamination.
Color changes from original in excess of 3.0 units Delta E when measured per ASTM D 2244.
Losses in light transmission beyond 6 percent from original when measured per ASTM D 1003.
 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Manufacturer: The design for polycarbonate panel skylight assemblies is based on Series 2500 base plate and low profile pressure cap system glazed with 20mm polycarbonate structured sheet by Duo-Gard Industries Inc. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. Duo-Gard Industries, Inc.: Series 2500, 20mm thick polycarbonate panel
 2. CPI Daylighting: Translucent Panel Canopy Systems.
 3. Wasco Products, Inc.: Standing Seam Polycarbonate Skylights.
 4. Super Sky Products Inc.: Single Slope Translucent Skylight Systems
 5. Note: Glass fiber reinforced thermo-set resin faces are not acceptable.

2.02 STRUCTURED POLYCARBONATE PANELS

- A. General: Translucent, extruded-polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
1. Plastic Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
 2. Burning Extent: 1 inch or less per ASTM D 635.
 3. Burning Rate: 2.5 in/.min. or less per ASTM D 635.
 4. Smoke-Developed Index: 450 or less per ASTM E 84, or 75 or less per ASTM D 2843.
 5. Flame-Spread Index: Not more than 25 per ASTM E 84.
 6. Exterior-Fire-Exposure Class: Class A per ASTM E 108 or UL 790.
 7. Color: Blue or as selected by the Authority from the Manufacturer's full range.
- B. Color Stability: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering according to procedures in ASTM D 1435.
- C. Outdoor Weathering Conditions: 120 months in a moderate North American climate. UV stabilization both sides of sheet.
- D. Impact Resistance: No failure at impact of 200 ft. x lbf according to free-falling-ball impact test using a 3-1/2-inch diameter, 6.3-lb ball.

2.03 ALUMINUM FRAMING SYSTEM

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
- C. Exposed Flashing and Closures: Manufacturer's standard prefinished aluminum components not less than 0.060 inch thick.
- D. Framing Gaskets: Manufacturer's standard.
- E. Framing Sealants: As specified in Division 7 Section "Joint Sealants."
- F. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, non-staining, and non-bleeding; compatible with adjacent materials.
1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.
 2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

G. Framing System Fabrication:

1. Fabricate components before finishing.
2. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within assembly to exterior.
3. Fabricate sill closures with weep holes and for installation as continuous component.
4. Reinforce components as required to receive fastener threads.
5. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.04 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Aluminum Finish:
 1. Manufacturer's standard clear anodized.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 4. Rigidly secure non-movement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 7. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

- C. Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
- D. Install components to drain water passing joints, condensation occurring within aluminum members, and moisture migrating within assembly to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch.
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/2 inch over total length

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Water-Spray Test: Panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 08 90 00

SECTION 09 21 00
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following:

1. Metal framing.
2. Insulation.
3. Gypsum and cement wall board and accessories.
4. DensGlass, or equivalent, gypsum panel sheathing board.

1.03 REFERENCES

- A. Refer to the following standards for reference.

1. ASTM C 36: Standard Specification for Gypsum Wallboard; 1993.
2. ASTM C 475: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 1993.
3. ASTM C 630/C 630M: Standard Specification for Water-Resistant Gypsum Backing Board; 1993.
4. ASTM C 645: Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board; 1994.
5. ASTM C 754: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum; 1988.
6. ASTM C 840: Standard Specification for Application and Finishing of Gypsum Board; 1994.
7. ASTM C 1002: Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases; 1993.
8. ASTM E 119: Standard Test Methods for Fire Tests of Building Construction and Materials; 1988.
9. Fire Resistance Directory; Underwriters Laboratories Inc. (UL); 1994.
10. GA-214-90 Recommended Specification: Level of Gypsum Board Finish; Gypsum Association; 1990.
11. GA-216-93 - Recommended Specifications for the Application and Finishing of Gypsum Board; Gypsum Association; 1993.

1.04 RELATED SECTIONS

- A. The following sections contain requirements that relate to this section:

1. Division 09: Painting.

1.05 SUBMITTALS

- A. General: Submit the following:
- B. Product data for each type of product specified, including installation instructions and data sufficient to show compliance with requirements.
 - 1. Each type of Gypsum Board specified or required.
 - 2. Metal framing components.
 - 3. Rigid insulation.
 - 4. Tape and joint compounds.
 - 5. Fastening devices.
 - 6. Vapor barrier.
 - 7. Trim pieces.
- C. Shop drawings for special assemblies designated on the drawings, including details sufficient to show compliance with design intent and performance requirements.
- D. Certification and details for fire rated assemblies. Certification and details for STC-rated assemblies.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications, Metal Framing: Provide installation by a company specializing in work similar to that required on this project and with not less than 5 years of documented experience.
- B. Installer Qualifications, Gypsum Board: Provide installation by a company specializing in work similar to that required on this project and with not less than 5 years of documented experience.
- C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board, accessories and other panel products from a single manufacturer. Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- D. Fire-Resistive Rating: Where indicated for fire-resistance ratings, provide materials and installations identical with applicable assemblies, which have been tested per ASTM E 119 and listed by a testing laboratory recognized by authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, construction traffic, corrosion, and other causes. Neatly stack and support gypsum panels flat and level to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.
- D. Store corner bead and other metal and plastic accessories to prevent bending, sagging, distortion, or other mechanical damage.
- E. Do not install gypsum panels that have become wet.

1.08 PROJECT CONDITIONS

- A. Environmental Conditions: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or with gypsum board manufacturer's recommendations, whichever are more stringent. For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F. Do not exceed 95 deg F when using temporary heat sources. Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.
- B. Ventilation: Provide controlled ventilation during joint finishing operations, to eliminate excessive moisture. Avoid drafts during hot, dry weather to prevent finishing materials from drying too quickly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Framing and Furring:
 - a. Clark Steel Framing Systems.
 - b. Consolidated Systems, Inc.
 - c. Dale Industries, Inc. - Dale/Incor.
 - d. Dietrich Industries, Inc.
 - e. MarinoWare; Division of Ware Ind.
 - f. National Gypsum Company.
 - g. Scafco Corporation.
 - h. Unimast, Inc.
 - i. Western Metal Lath & Steel Framing Systems.
 - 2. Gypsum Board and Related Products:
 - a. American Gypsum Co.
 - b. G-P Gypsum Corp.
 - c. National Gypsum Company.
 - d. United States Gypsum Co.
 - 3. Gypsum Panel Sheathing Board
 - a. DensGlass by Georgia-Pacific.
 - b. StoQui by Sto Corporation.

2.02 STEEL FRAMING MATERIALS

- A. General: Select size and gage of framing members and establish spacing to comply with requirements of ASTM C 754 unless otherwise specifically indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653, G60 hot-dip galvanized zinc coating.
- B. Minimum Base-Metal Thickness: 0.0312 inch.

- C. Size of runners and vertical members as shown on the drawings, unless noted otherwise or otherwise required structurally for actual conditions, loads or unsupported length.
- D. Steel framing materials to be secured to substrates and to each other with stainless steel or galvanized screws and anchors of type, size and length required for the actual application and conditions.
- E. Wire Ties: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1mm) diameter.
- F. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1-mm) diameter.
- G. Channels: Cold-rolled steel, 0.0598-inch (1.5-mm) minimum thickness of base (uncoated) metal and 7/16-inch- (11.1-mm-) wide flanges, and as follows:
 - 1. Carrying Channels: 1-1/2 inches (38.1 mm) deep, 475 lb/1000 feet (70 kg/100 m), unless otherwise indicated.
 - 2. Furring Channels: 3/4 inch (19.1 mm) deep, 300 lb/1000 feet (45 kg/100 m), unless otherwise indicated.
 - 3. Finish: Rust-inhibitive paint, except ASTM A 653, G 60 (ASTM A 653M,Z 180) hot-dip galvanized coating for framing for exterior soffits and where indicated.
- H. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- (5-mm-) wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal, width and limiting heights. Limiting heights are based on using 16" o.c. stud spacing with 1/2" thick Gypsum board panels and 5 psf load perpendicular to partition or furring with an allowable deflection of L/360.
 - 1. Wall Stud Depth and Limiting Height:

Limiting Height with One Layer of Gyp. Bd. Each Side and 25 ga Stud:

2 1/2"	9'-10"
3 5/8"	12'-4"
4"	13'-4"
6"	17'-11"
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant coating for exterior soffits and ceiling suspension members.
 - 3. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
 - 4. Stiffeners: 3/4" cold-rolled steel channels at 0.3 lb. Per ft., rust-inhibitive paint finish.
 - 5. Stud System Accessories: Provide stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system.
 - a. Steel Channel Bridging: Cold-rolled steel, 0.0598-inch (1.5-mm) minimum thickness of base (uncoated) metal and 7/16-inch- (11.1-mm-) wide flanges, 1-1/2 inches (38.1 mm) deep, 475 lb/1000 feet (45 kg/100 m), unless otherwise indicated.
 - b. Steel Flat Strap and Backing Plate: Steel sheet for blocking and bracing complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A

568M), length and width as indicated, and with a minimum base metal (uncoated) thickness as follows:

6. Thickness: 0.027 inch (0.7 mm) where indicated.
7. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.03 GYPSUM BOARD

- A. Interior Gypsum Wallboard: ASTM C 36; maximum lengths available to minimize end-to-end butt joints in each area receiving finished gypsum board. Edges to be tapered unless indicated otherwise. Provide the following type(s) as specified or required for interior applications, walls or ceilings:
 1. ½ inch regular gypsum board.
 2. Fire-resistant Type X, 5/8 inch.
 3. Moisture- and Mold-Resistant core and surfaces, 5/8 inch, Type X.
 4. Abuse-Resistant Type. Manufactured to produce greater resistance to surface indentation and impact resistance than standard. Regular, Type X, and/or moisture and mold resistant.
- B. Exterior Gypsum Wallboard: ASTM C 931; maximum lengths available to minimize end-to-end butt joints in each area receiving finished gypsum board. Provide the following type as specified or required for exterior applications, walls or soffits:
 1. Fire-resistant Type X, 5/8 inch.
 2. Glass-Mat Gypsum Sheathing Board: ASTM C 1177, 5/8 inch, Type X, "Dens-Glass Gold by G-P Gypsum.
 3. DensGlass Sheathing Board by Georgia-Pacific Gypsum LLC.
- C. Tile Backing Panels:
 1. Water-Resistant Gypsum Backing Board: ASTM C630; ½" or 5/8" thick as specified or required; Type X if specified or required.
 2. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178; DensShield Tile Guard by G-P Gypsum or equal.
 3. Complying with ASTM C 1177, "DensArmor Plus Interior Guard" by G-P Gypsum; ½" or 5/8" thick as specified or required; Type X if specified or required.
 4. Cementitious Backer Units: ANSI A108.1; ½" thick; by one of the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. USG Corporation; DUROCK Cement Board.
 - d. Approved equal.

2.04 TRIM AND ACCESSORIES

- A. General: Except as otherwise specifically indicated, provide trim and accessories by manufacturer of gypsum board materials, made of galvanized steel or zinc alloy and configured for concealment in joint compound. Trim to conform to ASTM C 1047.
- B. Include trim units necessary for project conditions. Provide accessories as required in order to achieve details indicated, whether or not specific accessories are shown on the drawings.

1. Cornerbead.
2. Bullnose bead.
3. LC-Bead.
4. L-Bead.
5. U-Bead.
6. Expansion joint trim.

2.05 JOINT TREATMENT

- A. General: Provide products by manufacturer of gypsum boards. Comply with ASTM C 475 and with manufacturer's recommendations for specific project conditions.
- B. Joint Tape: Manufacturer's standard paper reinforcing tape.
 1. Joint Tape for moisture-resistant Board: If recommended by manufacturer, provide open-weave fiberglass tape for joint treatment of water-resistant gypsum backing board.
- C. Setting Type Joint Compound: Chemical hardening type, for the following applications:
 1. Interior use: Taping and prefilling.
- D. Drying Type Joint Compound: Vinyl-based ready-mixed type for interior use, and as follows;
 1. Topping compound: Type specifically formulated for finishing drywall over taping compound.
- E. Joint Compound: At joints and fasteners in moisture-resistant gypsum board, provide compound specifically recommended or permitted by manufacturer of gypsum board.

2.06 MISCELLANEOUS GYPSUM MATERIALS

- A. General: Provide miscellaneous materials as produced or recommended by manufacturer of gypsum products.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated. Screws to be stainless steel or hot-dipped galvanized.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

2.07 INSULATION

- A. Rigid Insulation: Extruded Polystyrene Board Insulation: Rigid cellular polystyrene thermal insulation with closed cells and integral high-density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV; in manufacturer's standard lengths and widths; thicknesses as indicated.
 1. Adhesive: Type recommended by insulation board manufacturer for application indicated.
- B. Sound Attenuation Blankets: Unfaced mineral fiber blanket insulation produced by combining mineral fibers manufactured from slag wool or rock wool as required to achieve required acoustical and fire rating for the assembly, with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

- C. Thermal Insulation:
 - 1. Unfaced Mineral Fiber Blanket Insulation: Unfaced mineral fiber blanket insulation to comply with ASTM C 665 for Type I (blankets without membrane facing).

2.08 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspection: Verify that project conditions and substrates are appropriate to begin installation of work of this section.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Furnish inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.03 INSTALLATION OF STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install bracing at terminations in gypsum board assemblies. Install supplementary framing, blocking, and bracing to support fixtures, equipment services, heavy trim, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- D. Installation Tolerances: Install steel framing components for walls so members for panel attachment are level to within 1/8 inch in 12 feet (3 mm) in 3.6 m measured lengthwise on each member and transversely between parallel members.

3.04 INSTALLATION OF SUPPORT SUSPENSION SYSTEM

- A. Furnish and install hanger devices in coordination with other work.
- B. Secure hanger wires to structural support by wire-tying directly to structure where possible; otherwise, tie to inserts, clips or other anchorage devices or fasteners. Wire-tie

hanger wires to main runners.

- C. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
- D. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- E. Space main runners 4'-0" o.c. and space hangers 4'-0" along runners, except as otherwise shown.
- F. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.
- G. Wire-tie or clip furring members to main runners and to other structural supports.
- H. Space furring member 16" o.c., except as otherwise indicated closer.
- I. Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.
- J. For exterior soffits, provide cross bracing and additional framing required to resist wind uplift.

3.05 INSTALLATION OF WALL/PARTITION SUPPORT SYSTEM

- A. Where studs are installed directly against exterior walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
 - 1. Where indicated, secure furring members to wall with screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 inch clearance from jamb stud to allow for installation of control joint in finished assembly.

- c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- D. Install supplementary framing, solid blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings, woodwork, accessories and similar work.
- E. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Cut studs 1/2" short of full height.
- F. Space studs 16" o.c., except as otherwise indicated closer.
- G. Fasten studs only at ends of floor and ceiling runner tracks by installing a screw into both flanges at each end.
- H. Install horizontal stiffeners in stud system faced on one side only; space 4'-0" o.c. vertically; wire-tie at each intersection.
- I. Install horizontal stiffeners 6" above and 6" below each opening more than 3'-0" wide, and extend 2 regular stud spaces beyond each jamb.

3.06 EXTERIOR WALL INSULATION SYSTEM

- A. Fill spaces between studwork with blanket insulation cut to provide friction fit and to provide complete coverage.
- B. Cover surface with vapor barrier draped from top in as long lengths as practical. Lap and join over studs and seal with pressure sensitive vapor retardant tape.
- C. Extend vapor retarder to extremities of exterior insulated walls and to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose thermal insulation.
- D. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 inches on center.
- E. Seal joints in vapor retarder caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with cloth or aluminized tape which bonds permanently to vapor retarder.
- F. Repair any tears or punctures in vapor retarder immediately before concealment by application of gypsum board or other construction.

3.07 APPLYING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- C. Examine panels before installation. Reject panels that are wet, moisture damaged, and

mold damaged.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.08 APPLYING PANELS

- A. Install board panels horizontally, unless noted or approved otherwise, at right angles across framing to minimize the number of abutting end joints. Stagger abutting end joints of adjacent panels not less than one framing member.
- B. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- C. Locate edge and end joints over supports. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- D. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- E. Attach gypsum panels to framing provided at openings and cutouts.
- F. Form control and expansion joints with space between edges of adjoining gypsum panels.
- G. Fit gypsum panels around ducts, pipes, conduits, structural members and other protrusions.
- H. Isolate perimeter of gypsum board applied to non-load bearing partitions at structural abutments, except floors. Provide ¼ to ½ inch wide spaces at these at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

3.09 PANEL APPLICATION METHODS

- A. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws. Follow any requirements for fire rated walls.
- B. Multilayer Application: Apply base layer of gypsum panels to supports with steel drill screws. Apply face layer of gypsum panels offset over joints of base layer; fasten face layer separately with screws long enough to secure to supports. Face layer may also be secured with adhesive to the base layer if the method and adhesive is approved by the Authority. Follow any installation requirements for fire rated walls.

3.10 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. Bullnose Bead: Use at outside corners.
 - 3. LC-Bead: Use at exposed panel edges.
 - 4. L-Bead: Use where indicated.

5. U-Bead: Use at exposed panel edges.

3.11 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

3.12 CLEANING

- A. Promptly remove any residual gypsum drywall materials from adjacent or adjoining surfaces, leaving spaces ready for subsequent finishing operations and decorating.

END OF SECTION 09 21 00

SECTION 09 30 10
TACTILE TILE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 DESCRIPTION

- A. This section specifies furnishing and installing surface applied detectable tactile warning surface tiles where indicated, using an exterior grade tile with UV protection.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures, and routine maintenance.
- B. Samples for Verification Purposes: Submit three (3) samples of fasteners and full size samples of tactile tiles of the kind proposed for use showing full range of color and pattern variations.
- C. Shop Drawings are required for products specified showing fabrication details, composite structure, fastener locations, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory required.

1.04 QUALITY ASSURANCE

- A. Provide tactile tiles and accessories as produced by a single manufacturer, including mechanical fasteners.
- B. Installers Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project. Manufacturer's supervisor shall be present during all construction.
- C. Americans with Disabilities Act (ADA) Equivalent Facilitation: Provide tactile warning surfaces which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).
- D. Vitrified Polymer Composite Tile (VPC): Exterior grade tile with ultra-violet resistant additive shall be an epoxy polymer composition employing a minimum of 25% by weight aluminum oxide particles or equivalent in truncated domes and shall meet or exceed the following test criteria:
1. Tile Dimensions: Nominal 2'-0" x 4'-0" x 0.125" thick; 0.325" thick at the domes,

with a 1-1/8" deep front edge flange and 1/2" deep back flange. The first two rows of domes at the rear edges of the tiles away from the track shall be graduated in height 0.190" and 0.257" respectively. Tiles shall be formed with holes for anchors in the dome; minimum of 13 holes per tile. Three of the holes shall be in the first row of domes which overlaps and fastens through a 1-1/2" lap-flange in the next tile.

2. Water Absorption: When tested by ASTM C 373 shall not exceed 0.35%.
3. Slip Resistance: When tested by ASTM C 1028, the combined wet/dry static coefficient of friction shall be not less than 0.80.
4. Compressive Strength: When tested by ASTM D 695 shall be not less than 18,000 psi.
5. Tensile Strength: When tested by ASTM D 638 shall be not less than 10,000 psi.
6. Flexural Strength of Tile: When tested by ASTM C 293 shall not be less than 24,000 psi.
7. Gardner Impact to geometry "GE" of the standard: When tested by ASTM D 5420 shall have a mean failure energy expressed as a function of specimen thickness of not less than 450 in. lbf/in. A failure is noted if a hairline fracture is visible in the specimen.
8. Chemical Stain Resistance: When tested by ASTM D 543 shall withstand without discoloration or staining -1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.
9. Abrasive Wear of Tile: When tested by BYK - Gardner Tester ASTM D 2386 with reciprocating linear motion of ± 37 cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, was fixed and leveled to a holder. The combined mass of the sled, weight and wood block is 3.2 lb. Average wear depth shall not exceed 0.030 after 1,000 abrasion cycles measured on the top surface of the dome representing the average of three measurement locations per sample.
10. Fire Resistance: When tested by ASTM E 84 flame spread shall be less than 25.
11. Accelerated Weathering of Tile: When tested by ASTM G 26 for 2,000 hours shall exhibit the following result, no deterioration, fading or chalking of surface of tile.
12. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System: When tested by ASTM D 1037 shall show no evidence of cracking, delaminating, warping, checking, blistering, color change, loosening of the tiles or other defects.
13. Salt and Spray Performance of Tile and Adhesive System: When tested by ASTM B 117 shall not show any deterioration or other defects after 100 hours of exposure.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings, and tile type shall be identified by part number.
- B. Tiles shall be delivered to location at building site for storage prior to installation.

1.06 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40 degrees F in spaces to receive tactile tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40 degrees F in areas where work is completed.
- B. Dust from cutting, grinding or drilling shall be contained or removed by vacuum attached to equipment or by other means and shall not be allowed to spread into the atmosphere, among the workers, passengers or public, or to contaminate the area below or around the site.
- C. The use of water for work, cleaning or dust control etc. shall also be contained and controlled and shall not be allowed to come in contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- D. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- E. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.
- F. Contractor shall coordinate phasing and flagging personnel operations as specified in the contract documents.

1.07 EXTRA STOCK

- A. Deliver extra stock to CTA West Shops, 3901 W. Maypole Street, Chicago, IL 60624, Attention: James Jenkins. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification. Furnish not less than ten (10)% of the supplied materials, for each type, color, pattern installed including fasteners. Furnish not less than twenty (20)% of concealed caps.

1.08 GUARANTEE

- A. Tactile tiles shall be guaranteed in writing, signed by the Manufacturer and the Contractor, for a period of ten years from date of Final Acceptance. The guarantee includes defective materials and installation, loosening of fasteners or tiles, defective bonding of adhesives or sealants, breakage, cracked, chipped or broken tiles, marred or defaced surface, deformation, fading and chalking of finishes, cracked or open joints, and improper slope for drainage, or improper elevation of leading edge causing tripping.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tiles on concrete specified is based on Armor-Tile manufactured by Engineered Plastics Inc (1-800-682-2525). Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet

or exceed the specified test criteria and characteristics:

- a. Color: Blue (AT-B-2070); Process Blue, Pantone Matching System (PMS).

2.02 MATERIALS

- A. Fasteners: 1/4" x 2" stainless steel flat head bolt expansion anchors to be positioned in the molded recessed holes of the truncated domes.
- B. VPC Dome Caps: Truncated dome caps shall be press fit and bonded into corresponding truncated domes in tiles.
- C. Adhesive: Heavy duty elastomeric polyurethane adhesive system.
- D. Closed Cell Foam: Closed cell foam rope size as indicated, by Sonoco or approved equal.
- E. Joint Sealant: Heavy duty elastomeric polyurethane sealant system.

PART 3 EXECUTION

3.01 GENERAL

- A. Comply with applicable requirements of the tile manufacturer's installation instructions. Ensure that adequate safety precautions and job site protection are being maintained.
- B. At precast concrete platforms, saw cut a clean straight groove 1/4" wide and 3/8" deep (or as otherwise required by manufacturer) at proper distance in from track center line (Approx. 24" from edge of platform) in platform to receive tile leading edge lip. Tile track edge at platform edge shall be in line to follow the platform edge at proper distance from center of track (4'-7"). Cut or grind platform track edge to maintain tile at proper distance from center of track. Provide plastic edge shim pieces securely anchored to platform track edge for support under tile where void space is over 1/4".
- C. Grind or plane platform surface down sufficient depth for new tile and adhesive, smooth and level surface to remove any projections or high points from interfering with installation of tiles. Provide slope to platform edge for water drainage.
- D. The surface shall be vacuumed and cleaned free from dirt, debris, and dust. Inspect surface and grind away or plane any obstructions or bumps. Clean sawcut of any obstructions or foreign matter without chipping or damaging the sawcut.
- E. Install adhesive according to manufacturer's recommendations. Set tiles in place; adjust and align, Drill holes and fasten stainless steel fasteners in pre-located holes in tiles. Do not install tiles over expansion joints or install tile with shi lap edge exposed. Tile edges at platform edge shall be in a straight line to follow platform edge at proper distance from center of track. Fasteners in first row of domes at inside leading edge of tiles shall hold tile down to prevent the leading edge from buckling or causing a tripping hazard. Remove any tiles with such deformed edge and replace.
- F. The leading edge of the tile shall be checked to ensure the tolerance provided is in accordance with the contract drawings. Adjust as required.
- G. Allow a gap of 1/8" or as otherwise directed by the manufacturer for expansion and contraction.

- H. At construction joints between precast concrete panels provide adhesive under tile and between shiplap joints spanning construction joints.
- I. Layout tiles and joints to fit at expansion joints in precast concrete slabs. Provide tiles with largest size units as possible at ends, but not less than a half unit. Tiles shall not cover expansion joints.
- J. Maintain expansion joints in platforms and any other reference marker or openings that may be required to be left exposed.
- K. Prepare pre-located holes in domes by abrading surface and cleaning and add caps in accordance with manufacturers specifications. Set VPC concealed caps into recesses on truncated domes with the polyurethane adhesive to fasten, conceal and protect the fastener locations. Surfaces to receive adhesive shall be clean of any dust, grease, or other contaminants. Apply the recommended amount of adhesive in the corresponding recesses of the truncated domes, in accordance with the manufacturer's specifications. Tap concealed caps in place with a plastic mallet. Care shall be taken to avoid any excess adhesive flowing out from around the concealed cap when inserted.
- L. Provide sealant at joints as recommended by manufacturer.

3.02 CLEANING AND PROTECTION

- A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specifications.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of Substantial Completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

3.03 WARRANTY INSPECTIONS

- A. In addition to any warranty provisions covered by these specifications, the Contractor shall perform complete inspections of the tactile tile installations. The inspections shall be conducted Monday to Friday, normal daytime hours. The warranty inspections shall take place eleven (11) months from the date of final acceptance by the Commissioner of each station installation. The Commissioner's representative will accompany the Contractor on the inspections.
- B. The Contractor shall prepare and submit to the Authority a written report with two (2) copies, stating the condition of the installations outlining any modifications to the maintenance specifications or procedures and respond in writing to questions raised by the Architect or maintenance personnel during the inspection periods.
- C. As part of the inspections, Contractor shall at no cost to the Commissioner completely replace any tactile tile or installation showing undue wear or damage from ordinary use, cracked or broken tile, loose or malfunctioning fasteners, separation from substrate, cracked loose or damaged sealant or adhesive, hollow areas underneath tiles, discoloration of tiles or adhesive from natural causes, or the wrong height or slope of the tiles for proper drainage or to avoid tripping. This shall be furnished as part of the guarantee obligation by the Contractor.
- D. The inspections shall be performed by the Contractor's service representative. All costs involved with each of these inspections such as travel, accommodations, international

charges, fees, tools, equipment and parts costs, shall be paid in full by the Contractor.

- E. Contractor shall notify the Commissioner in writing at least two (2) weeks prior of the intent to conduct the tactile tile warranty inspections.

END OF SECTION 09 30 10

SECTION 09 60 00
STONE FLOORING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes granite flooring, related setting materials, and accessories.

1.03 RELATED WORK

- A. Section 07 90 00, Joint Sealants

1.04 REFERENCES

- A. ASTM C241 – Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
- B. ASTM C615 - Standard Specification for Granite Dimension Stone
- C. ASTM C1028 – Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
- D. NBGQA 2002 – Specifications for Building Granite; National Building Granite Quarries Association.

1.05 DEFINITIONS

- A. Stone flooring is fabricated from natural stone to produce nongauged units 1-1/4 inch thick. Stone flooring units require thick mortar bed setting. Provide manufacturer's recommended thickness for wall base and mortar bed setting.
- B. Module size: Actual tile size plus joint width.

1.06 PERFORMANCE REQUIREMENTS

- A. Stone Abrasion Resistance: Minimum abrasive hardness of 12, as determined per ASTM C241.
- B. Static Coefficient of Friction: Per ASTM C1028:
1. Level Surfaces: Minimum 0.6.
 2. Sloped Surfaces: Minimum 0.8

1.07 SUBMITTALS

- A. Product Data: As follows:
1. Each stone type.
 2. Setting and grouting materials.
 3. Surface sealers.
 4. Cleaning products.

5. Stair abrasive bar inserts.
 6. Mastic for stair abrasive bar inserts.
- B. Maintenance data to be included in the Maintenance Manual supplied at Contract Closeout.
- C. Samples for each color, grade, finish, type, and variety of stone consisting of 12 inch-square units. Include a minimum of three units in each set showing the full range of visual characteristics to be expected in the completed Work.
1. Obtain samples from same source to be used in the Work of this Section.
- D. Shop drawings indicating cut sizes, dimensions, sections, and profiles of stone units, joint patterns, and details showing relationship of units to adjacent work. Show installation details at special and substrate conditions.

1.08 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in supplying products similar to those indicated for this Project with a record of successful in-service performance.
- B. Installer Qualifications: Engage an experienced Installer who has completed interior stone flooring and tread installations that are similar in material, design, and extent as that indicated for this Project and that have performed successfully.
- C. Single-Source Responsibility for Stone: Obtain each color, grade, finish, type, and variety of stone from a single source with resources to provide materials of consistent quality in appearance and physical properties, including capacity to cut and finish material without delaying the progress of the stone installation.
- D. Single-Source Responsibility for Setting Materials: Obtain mortar and grout mix ingredients of uniform quality, from one manufacturer for each cementitious and admixture component, and from one source or producer for each aggregate.
- E. Field-Constructed Mockup: Build mockup to comply with the following requirements:
1. Minimum mockup must include:
 - a. Floor: Area as indicated on the Drawings. Include a floor to wall joint if floor meets stone wall surface or stone base.
 2. Notify IDOT 1 week in advance of date and time when mockups will be erected.
 3. Demonstrate proposed range of workmanship and visual attributes.
 4. Obtain IDOT's acceptance of visual qualities before proceeding with complete installation.
 5. Retain and maintain mockups during installation of stone flooring as a standard for judging completed work. Do not alter or move mockup until stone flooring is accepted.
 6. Accepted mockups in an undisturbed condition at the date of Substantial Completion will become part of the completed stone flooring.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabricator's instructions and specifications for delivery, storage, and handling requirements.
- B. Deliver materials to Project site in an undamaged condition.

- C. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or cracking.
 - 1. Do not use pinch or wrecking bars to move stone units.
 - 2. Lift stones with wide belt-type slings where possible. Do not use wire rope or ropes containing tar or stain-causing substances. Use cushion-protected wood rollers and lifting devices when required to move stone.
 - 3. Store stones on protected wood skids or pallets, covered with nonstaining, water-protective membrane. Place skids and stack stones to distribute weight evenly and to prevent stones from breaking or cracking. Allow air to circulate around stones.
 - 4. Store cementitious materials off ground, under cover, and in a dry location.
 - 5. Store aggregate materials covered and in a dry location.

1.10 PROJECT CONDITIONS

- A. Do not set stone when air temperature or material temperature is below 50 degrees Fahrenheit.
- B. Maintain minimum ambient temperatures of 50 degrees Fahrenheit during installation and for 7 days after completion, unless higher temperatures are required by manufacturer's instructions.

1.11 SEQUENCING AND SCHEDULING

- A. Sequence stone flooring installation with adjoining and related work to minimize damage and soiling during construction.

PART 2 PRODUCTS

2.01 STONE FLOORING AND BASE, GENERAL

- A. Comply with referenced standards and product requirements indicated and applicable to each stone type required.
- B. Provide matched blocks from a single quarry for each type, variety, color, and quality of stone required.
 - 1. Extract blocks from a single bed of quarry stratum reserved for this Project.
 - 2. Select stones from selected blocks visually acceptable to IDOT.
- C. Source Approval by IDOT: Make quarried and cut blocks available for IDOT's approval during quarry operation and prior to shipment to fabricator or prior to fabrication.
- D. Require fabricator to coordinate and inspect quarrying for this Project to ensure quarried block orientations produce finished stone with specified characteristics.
- E. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function, and from a single quarry for each stone type with the following characteristics:

2.02 GRANITE

- A. Granite Dimension Stone Standard: ASTM C615.

- B. Finish of Granite: Exposed surfaces:
 - 1. Velvet.
- C. Granite Color and Grain: Color as selected and grain as directed by the Commissioner.
- D. Granite Types and Sources: Subject to compliance with requirements, provide the granite as indicated on Drawings.

2.03 MORTAR MATERIALS

- A. Aggregate: ASTM C144 as indicated below:
 - 1. For pointing mortar, use aggregate graded with 100 percent passing a No. 16 sieve.
 - 2. White Aggregates: Natural washed white sand or ground white stone.
 - 3. Colored Aggregates: Ground marble, granite, or sound colored stone acceptable to IDOT.
- B. Colored Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for mortar mixes. Use only pigments with records of satisfactory performance in stone mortars.
 - 1. Products:
 - a. SGS Mortar Colors, Solomon Grind-Chem Services, Inc.
 - b. True Tone Mortar Colors, Davis Colors, a subsidiary of Rockwood Industries.
 - c. Sonobrite, Sonneborn.
- C. Water: Potable.
- D. Latex-Portland Cement Mortar: CTI A118.4, composition as follows:
 - 1. Water Emulsion Latex Additive: Add at Project site to the factory-packaged dry mortar mix specified or as specified by latex additive manufacturer.

2.04 GROUT

- A. Grout Colors: Provide colors to comply with the following requirements:
 - 1. As selected by Commissioner.

- B. Latex-Portland Cement Grout: CTI A118.6, of the following composition:
1. Latex additive (water emulsion) serving as a replacement for part or all of gauging water, added at job site to factory-packaged dry grout mix, with type of latex and dry grout mix complying with requirements indicated below:
 - a. Latex Type: Styrene butadiene rubber.
 - b. Sanded Dry Grout Mix: Mix provided by or complying with latex additive manufacturer's requirements for use with latex additive.

C. Manufacturers:

1. Latex-Portland Cement Grouts:
 - a. American Olean Tile Co., Inc.
 - b. Custom Building Products.
 - c. C-Cure Chemical Co., Inc.
 - d. H. B. Fuller Co.
 - e. Jamo, Inc.
 - f. Laticrete.
 - g. Mapei.

2.05 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including coloring pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or calcium chloride, unless indicated otherwise.
- B. Mixing: Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer. Comply with referenced ASTM or ANSI standard, as applicable, for mixing time and water content, unless indicated otherwise.
- C. Joint Grout: Comply with mixing requirements of ANSI Standards referenced for materials, color, and installation methods.

2.06 MORTAR, GROUT AND ADHESIVE MANUFACTURER

- A. Subject to compliance with and performance requirements, provide products by one of the following manufacturers: Laticrete International, Inc. and Mapei Corporation
 1. Latex Portland Cement Adhesive Mortar Leveling Bed and Grouting Mortar must be weather, frost, shock resistant and must meet the following physical requirements in compliance with ANSI A1 18.4 test methods:
- B. Compressive strength: Thin bed bonding, grouting mortars - 5000psi (34.5 MPa) Min.
- C. Tensile strength: Thin bed, bonding, grouting mortars - 500 psi (3.5 MPa) Min.
- D. Bond strength: Thin bed, bonding, grouting mortars - 500 psi (3.5MPa) Min.
- E. Water absorption - 4% Max.
- F. Ozone Resistance: 200 hours @ 200 ppm - No loss of strength.
- G. Smoke & Flame contribution factors – 0

2.07 INSTALLATION SYSTEM ACCESSORIES

- A. Subject to compliance with performance requirements, provide products by one of the following manufacturers: Laticrete International, Inc. and Mapei Corporation.
- B. Waterproofing and anti-fracture membrane must be thin, cold applied, load bearing and non-toxic. The waterproof membrane must be resistant to urine, dilute acid, alkali, sugar, brine, and food waste products. Reinforcing fabric must be non-woven rot-proof fabric specifically for use with waterproof membrane. All materials must be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured. Waterproofing, crack suppression & anti-fracture membranes must be in compliance with the physical requirements and test methods as described in ANSI 118.10:
1. Water Permeability (at 30ft.hydro/0.9 atmos/91.2kPa): Nil
 2. Elongation at break (ASTM D-75 1-00): 20-30%
 3. Service Temperatures: -20°to+2800F (-280 to +137°C)
 4. Tensile breaking strength: 2950 psi
 5. Thickness: 20 mils (0.5mm)
 6. Bond strength to concrete: 350 psi
 7. Resistance to chemicals (90 day immersion):
 - a. Brine solution: Not Affected
 - b. Sugar solution: Not Affected
 - c. Milk: Not Affected
 - d. 10% Acid: Not Affected
 - e. 10% Alkali: Not Affected
 - f. Toluol: Softens
 - g. Urine: Not Affected
 - h. Rubber solvents or ketones: Not Recommended
 - i. Calcium chloride: Excellent
 - j. Aromatic solvents: Not Recommended
 8. Floor Tile Installation Evaluation (ASTM C627-93(1999): 900 cycles
 9. Service Rating (TCA): Extra Heavy Duty

2.08 MORTAR, GROUT, ADHESIVE & ACCESSORY PRODUCTS

- A. Installation system components are:
1. LATICRETE System components as manufactured by LATICRETE International, Inc. Bethany, CT 06525-3498 USA.
 2. MAPEI Corporation system components as manufactured by MAPEI Corporation, Deerfield Beach, FL 33442 USA.
 3. Other manufacturers and products are acceptable if the specified criteria are met or exceeded.
- B. Latex-Portland cement mortar complying with ANSI A 1 1 8.4:
1. LATICRETE 21 1 Crete Filler Powder gauged with LATICRETE 4237 Latex Thin Set Mortar Additive as manufactured by LATICRETE International, Inc.
 2. MAPEI Keracrete Powder with Ker 303 Keracrete Latex Thinset Mortar Additive as manufactured by MAPEI Corporation.
 3. Other manufacturers and products are acceptable if the specified criteria are met or exceeded.
- C. Waterproof/ Anti-Fracture Membranes:
1. Liquid Applied: LATICRETE 9235 Waterproof Membrane.
 2. Liquid Applied: MAPEI PRP M-19 Membrane or Mapelastic HPG

3. Trowel Applied: MAPEI Mapelastic 3 15 cement based membrane
 4. Other manufacturers and products are acceptable if the specified criteria are met or exceeded
- D. Polymer Modified, Antimicrobial, Sanded Grout complying with ANSI 118.6:
1. LATICRETE 1500 Series Grout mixed with LATICRETE 1776 Grout Admix
 2. MAPEI Ker 700 Ultra Color Grout or Keracolor S Sanded Grout
 3. Other manufacturers and products are acceptable if the specified criteria are met or exceeded
- E. Sealant: LATICRETE Flexible Sealant as manufactured by LATICRETE International, Inc.

2.09 ACCESSORIES

- A. Cleaner: Provide stone cleaners specifically formulated for stone types, finishes, and applications indicated as specified by stone producer, and if a sealer specified, by sealer manufacturer. Do not use cleaning agents containing acid or cleaning compounds and solutions containing caustic or harsh fillers, except where expressed by written approval from the stone producer for stone type condition.
- B. Floor Sealer: Colorless, slip- and stain-resistant sealer, not affecting color or physical properties of stone surfaces as specified by stone manufacturer for application indicated.

2.10 FABRICATION

- A. General: Fabricate interior stone flooring in sizes and shapes required to comply with requirements indicated, including details on Drawings and final shop drawings.
1. Granite: As specified by National Building Granite Quarries Association, Inc. (NBGQA) in "Specifications for Architectural Granite."
- B. Cut stones to fit stone pattern as indicated on Drawings and final shop drawings. Produce units to minimize field cutting for thickness, face sizes, and within fabrication tolerances specified by applicable stone association or stone source.
- C. Face Sizes: As indicated on Drawings and final shop drawings.
- D. Thickness: As indicated on Drawings and final shop drawings.
- E. Stone Edges: Square.
- F. Produce joints of uniform width. Joints shall be 1/8" in thickness.
- G. Clean sawn backs of stones to remove rust stains and free iron particles.
- H. Flatness Tolerances: Maximum variations for honed, and fine-rubbed surfaces at bed and joint arris lines; 3/64 inch or 1/16 of specified joint width, whichever is greater.
1. Beds and Joints: Bed and joint surfaces cut or sawn full square for specified minimum thickness of unit.
 2. Backs sawn or roughly dressed to approximate true planes. Maximum variation plus or minus 1/8 inch.
- I. Finish exposed faces and edges of stones to comply with requirements indicated for finish under each type and application of stone and to match approved samples and field-

constructed mockup.

- J. Carefully inspect finished stones at fabrication plant for compliance with requirements relative to qualities of appearance, material, and fabrication. Replace defective stones with units that comply.
 - 1. Grade and mark stones for overall uniform appearance when assembled in place.
Natural variations in appearance are acceptable if installed stones match range of colors and other appearance characteristics are represented in approved samples and field-constructed mockups.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive stone flooring and conditions where stone will be installed. Review with the Installer present for compliance with requirements for tolerances and conditions affecting installation performance. Report in writing conditions not complying with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Before installing stone flooring, clean substrates to remove dust, debris, and contaminants not compatible with setting material.
- B. Substrates shall be free of previously applied surface material. Prepare substrate surfaces to accept new material.
- C. Illuminate areas of installation with permanent or temporary lighting or a combination of both.
- D. Verify that materials are those specified before installing.

3.03 INSTALLATION, GENERAL

- A. Install stone flooring only on sound substrates.
- B. Set stones to comply with Drawings and final shop drawings.
- C. Do not use stone units with chips, cracks, voids, stains, or defects visible in the finished Work.
- D. Match stones for color and pattern by using units numbered in sequence as indicated on final shop drawings.
- E. Wash stone unit faces to remove loose material and soil.
- F. Scribe and field-cut stone if necessary to fit at obstructions. Produce tight and neat joints.
- G. Apply cement paste with a stiff brush or trowel-on a slurry coat of cement compatible with setting bed material type to bed face of stone prior to setting each unit.
- H. Set individual stones into screeded and fully compacted setting bed material. Beat stone into setting bed to ensure 100 percent contact between back of stone and setting

material. Take care to maintain accurate surface, joint alignment, and spacing. Do not realign stone after bed material has taken initial set.

- I. Fill joints with grout as specified by setting material manufacturer.
- J. Grout stone joints to comply with the following requirements:
 - 1. Sand-portland cement, dry-set, and latex-portland cement grouts comply with CTI A108.10.

3.04 INSTALLATION TOLERANCES

- A. Variation in Surface Plane of Flooring: Do not exceed 1/8 inch in 10 feet from level or slope indicated when tested with a 10-foot straight edge.
- B. Variation in Joint Width: Do not exceed 1/8" variation over three consecutive joints in any direction.

3.05 ADJUSTING AND CLEANING

- A. Remove stone flooring with the following defects:
 - 1. Broken, chipped, stained, or otherwise damaged stones.
 - 2. Defective joints.
 - 3. Stones and joints not matching approved samples and field-constructed mockups.
 - 4. Stone flooring not complying with requirements indicated.
- B. Replace damaged stone flooring with new units to match approved samples and field-constructed mockups without evidence of replacement.
- C. Clean stone flooring after setting and grouting is complete. Use procedures specified by stone fabricator for types of application.
- D. Apply sealer to cleaned stone flooring according to sealer manufacturer's printed instructions.
- E. Removal and reinstallation of stone flooring and base that does not meet the installation tolerance criteria shall be as directed by the Commissioner and performed at no expense.

3.06 PROTECTION

- A. Prohibit traffic from installed stone for a minimum of 72 hours.
- B. Protect set, and grouted stone flooring during construction with non staining kraft paper. Where adjoining areas require construction work access, cover stone flooring with a minimum of 3/4-inch untreated plywood over kraft paper.
- C. Before inspection for Substantial Completion, remove protective covering and clean surfaces using procedures, products, and materials specified by the stone producer.

END OF SECTION 09 60 00

SECTION 09 65 13
RESILIENT WALL BASE AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Section includes: Vinyl wall base and accessories as indicated on the drawings and as specified including adhesive and accessories.

- B. Related Sections include the following:

1. Division 09 Section "Sealants".

1.03 SUBMITTALS

- A. Product Data: Submit data for each type of product specified including base, preformed corners, adhesive and accessories.
- B. Installation Instructions and Recommendations: For all materials.
- C. Samples: Samples consisting of actual wall base showing height of wall base, base type, base style and showing full range of colors and patterns available for each type of resilient wall base indicated.
- D. Maintenance Data: Submit maintenance data for resilient wall base, to include in Operating and Maintenance Manual.
- E. Qualification Data: For qualified installer.
- F. Warranty: Copy of warranty covering materials and installation for Authority's review and approval.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility for Resilient Wall Base: Obtain each size, type and color of wall base including preformed corners from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- C. Fire Performance Characteristics: Provide resilient floor tile with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
1. Critical Radiant Flux: 0.45 watts per sq cm or more per ASTM E 648.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver resilient products and installation materials to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store resilient products and installation materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F and 90 deg F.
- C. Store resilient base on flat surfaces. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1.06 PROJECT CONDITIONS

- A. Maintain a minimum temperature of 70 deg F in spaces to receive wall base for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.
- B. Install wall base after other finishing operations, including painting, have been completed.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 250 linear feet or fraction thereof of each type, color, style and size of resilient wall base.
 - 2. All whole units of all leftover material.

PART 2 PRODUCTS

2.01 RESILIENT BASE

- A. Resilient Base Standard: ASTM F 1861. Vinyl base; of solid, homogeneous construction; with requirements specified.
 - 1. Style: Cove base with shoe or straight.
 - 2. Surface: Smooth.
 - 3. Thickness: 0.125 inch.
 - 4. Height: 6 inches as indicated on the drawings or as selected by the Authority.
 - 5. Colors and Patterns: As selected by the Authority from manufacturer's full range of colors and patterns produced for the wall base.
 - 6. Lengths: 48 inches.
 - 7. Outside Corners: Preformed or job formed as indicated on the drawings or as selected by the Authority.
 - 8. Inside Corners: Preformed or job formed as indicated on the drawings or as selected by the Authority.
 - 9. Finish: Satin, Matte or as selected by the Authority.
 - 10. Manufacturers:
 - a. Armstrong –Standard Excelon, Imperial Texture
 - b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - c. Johnsonite.
 - d. Roppe Corporation, USA.

e. Approved Equal.

2.02 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas where installation of base will occur, with Installer present, to verify that substrates and conditions are satisfactory for tile installation and comply with tile manufacturer's requirements and those specified in this Section.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other sections of the specifications and that substrates are free of cracks, ridges, depressions, scale and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install floor tiles until they are at the same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates and areas where resilient products are to be installed immediately before installation. Remove dust and dirt.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 RESILIENT BASE INSTALLATION

- A. Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in the Project.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.

- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing tile installation:
 - 1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturer from exposed surfaces.
 - 2. Sweep or vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 - 1. Cover resilient products until Substantial Completion.

3.05 WARRANTY

- A. All materials and workmanship shall be warrantied for a period of one year after date of substantial completion. Any resilient base that becomes discolored shall be replaced at no cost to the Authority. Any wall base that becomes dislodged from the substrate must be re-installed or replaced at no cost to the Authority and to the satisfaction of the Authority.

END OF SECTION 09 65 13

SECTION 09 90 00
PAINTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this section.

1.02 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces. Surface preparation, priming, and finish coats specified in this section are in addition to galvanizing, shop priming and surface treatment specified under other sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, IDOT will select from standard colors or finishes available.
- C. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), exposed conduit, hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment in areas within public view.
- D. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels. Unless noted otherwise, provide finish coats of paint over primed surfaces.
1. Prefinished items not to be painted include the following factory-finished components:
 - a. Elevator entrance doors, frames & equipment.
 - b. Finished mechanical and electrical equipment.
 - c. Light fixtures.
 - d. Switchgear.
 - e. Distribution cabinets.
 - f. Cables.
 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - a. Pipe spaces.
 - b. Duct shafts.
 3. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Brass.
 - e. Hot Dip Galvanized Steel
 4. Operating parts not to be painted include moving parts of operating equipment such as the following:

- a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- E. The floors and wall base at CMU walls shall be sealed with at least two coats of a vapor-proof sealant, per manufacturer instructions, where applicable. After sealing, the floor and wall base shall be primed and then painted with an epoxy paint floor cover. The floor paint shall act as a contaminant barrier and provide a hard, yet elastic, durable, damage-resistant surface. The floor and wall base paint shall be Dura-Seal 400 or Commissioner approved equivalent. If color or finish is not designated, the Commissioner will select the color or finishes. Provide custom colors when requested by Commissioner.

1.03 RELATED WORK

- A. Section 05 50 00, Metal Fabrications
- B. Section 08 13 00, Stainless Steel Doors and Frames
- C. Section 09 96 00, High Performance Coatings for painting of structural steel.

1.04 REFERENCES

- A. ASTM D1055 – Standard Specifications for Flexible Cellular Materials-Latex Foam.
- B. ASTM D1644 – Standard Test Methods for Nonvolatile Content of Varnishes.
- C. ASTM D2246 – Standard Test Method for Finishes on Primed Metallic Substrates for Humidity-Thermal Cycle Cracking.
- D. ASTM G53 – Standard Practice for Operating Light- and Water- Exposure Apparatus (Fluorescent UV Condensation Type) For Exposure of Nonmetallic Materials.
- E. SSPC SP2 – Hand Tool Cleaning.

1.05 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.06 SUBMITTALS

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Warranty: Provide a written warranty, in a form acceptable to IDOT, from the coating manufacturer, countersigned by the applicator, stating that the system provided is as specified and any defects due to materials and/or workmanship shall be repaired and/or replaced at no cost to the Commissioner for a period of 5 years from time of final acceptance by the Commissioner.

- C. The coating manufacturer shall submit certification that the products in a multi-layer coating system are appropriate for the intended use, and are compatible with each other and with project substrates.
- D. Samples for initial color selection in the form of manufacturer's color charts. After color selection, the Architect will furnish color chips for surfaces to be coated.
- E. Samples for verification purposes. Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
- F. Contractor to submit all proposed finish systems and materials for Architects's approval, whether specified herein or not. Due to periodic changes in regulations, requirements, or manufacturer's designations since this specification was written; specified systems and products may have to be updated.

1.07 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify the Architect of problems anticipated using the materials specified.
- C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full coat finish samples on at least 100 sq. ft. of surface until required sheen, color and texture are obtained; simulate finished lighting conditions for review of in-place work.
 - 1. Final acceptance of colors will be from job-applied samples.
 - 2. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface in accordance with the schedule or as specified. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.
- D. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.
 - 2. Federal Specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.
 - 3. Products that comply with qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to the Engineer. Furnish material data and manufacturer's

certificate of performance to Engineer for proposed substitutions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Federal Specification number, if applicable.
 - 4. Manufacturer's stock number and date of manufacture.
 - 5. Contents by volume, for pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees Fahrenheit (7 degrees Centigrade). Maintain containers used in storage in a clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.09 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees Fahrenheit (10 degrees Celsius) and 90 degrees Fahrenheit (32 degrees Celsius).

- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees Fahrenheit (7 degrees Celsius) and 95 degrees Fahrenheit (35 degrees Celsius).

- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 degrees Fahrenheit (3 degrees Celsius) above the dew point, or to damp or wet surfaces.

- D. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Coatings:

1. Benjamin Moore and Co. (Moore)
2. Carboline Company (Carboline)
3. ICI Paints (ICI)
4. PPG Industries (Pittsburgh)
5. Pratt and Lambert (P & L)
6. The Sherwin-Williams Company (S-W)
7. Tnemec Company, Inc. (Tnemec)

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
6. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

2.02 SEALANT

- A. The sealant shall be a non-toxic, penetrating, and permanent concrete sealer.
- B. The sealant shall act as a vapor barrier, alkali and corrosion inhibitor, curing agent and dust-proof compound.
- C. The sealant for the floor shall be Moxie Flooring Sealant II (MFSII) or Commissioner approved equivalent.

2.03 PRIMERS (OTHER THAN FOR FERROUS METALS)

A. Interior Flat Latex-Based Paint: Flat latex paint used as a primer over concrete masonry under alkyd flat and semigloss enamel:

1. Carboline: Carbocrylic 120 Waterborne Acrylic.
2. ICI: 3030 Bond-Prep Int/Ext Waterborne Pigmented Bonding Primer.
3. Moore: Moore's Latex Quick-Dry Prime Seal #201.
4. Pittsburgh: Speedhide Interior Flat Latex 6-70 Series.
5. P & L: Vapex Latex Flat Wall Finish.
6. S-W: Pro-Mar 200 Latex Flat B30W200.

B. Galvanized Metal Primer: Primer used to prime interior zinc-coated (galvanized) metal surfaces:

1. Devoe: 13201 Mirrolac Galvanized Metal Primer
2. Glidden: 5229 Glid-Guard All-Purpose Metal Primer
3. Moore: Ironclad Galvanized Metal Latex Primer #155

4. Pittsburgh: 6-215/216 Speedhide Galvanized Steel Primer
5. S-W: Galvite HS B50WZ3

C. High-Performance Latex Block Filler: Heavy-duty latex block fillers used for filling open textured interior concrete masonry block before application of top coats:

1. Carboline: Sanitile 100 Acrylic Block Filler.
2. ICI: 4000 Blox-Blox Int./Ext. Heavy Duty Acrylic Block Filler.
3. Moore: Moorcraft Block Filler #145.
4. Pittsburgh: 6-7 Latex Masonry Block Filler.
5. S-W: Heavy-Duty Block Filler B42W46.
6. Tnemec Series 130.

2.04 UNDERCOAT MATERIALS (OTHER THAN FOR FERROUS METALS)

A. Interior Enamel Undercoat: Ready-mixed enamel for use on the interior as an undercoat over a primer on concrete masonry under an odorless semigloss enamel:

1. Carboline: Carbocrylic 120 Waterborne Acrylic.
2. ICI: 1120 Ultra Hide Alkyd Interior Undercoater.
3. Moore: Moore's Alkyd Enamel Underbody #217.
4. Pittsburgh: 6-6 Speedhide Quick-Dry Enamel Undercoater.
5. P & L: E6 Enamel Undercoater.
6. S-W: Prep Rite 200 Latex Wall Primer B28W200.

2.05 INTERIOR FINISH PAINT MATERIAL (OTHER THAN FOR FERROUS METALS)

A. Interior Semigloss Odorless Alkyd Enamel: Low-odor, semigloss, alkyd enamel for use over a primer and undercoat on concrete masonry and both ferrous and zinc-coated (galvanized) metal surfaces.

1. Carboline: Carbocoat 139 Urethane Alkyd.
2. ICI: 1507 Dulux Ultra Semi Gloss Alkyd Interior Enamel.
3. Moore: Moore's Satin Impervo Enamel #235.
4. Pittsburgh: Speedhide Interior Semi-Gloss Alkyd Enamel, 6-110 Series.
5. P & L: Cellu-Tone Alkyd Satin Enamel.
6. S-W: Pro-Mar 200 Alkyd Semi-Gloss B34 Series.
7. Tnemec: Series 23.

B. Exterior alkyd gloss enamel for use over above specified primer and undercoat on ferrous and zinc-coated metal surfaces:

1. Carboline: Carbocoat 139 Urethane Alkyd.
2. ICI: 4308 Devguard Alkyd Industrial Gloss Enamel.
3. Moore: Impervo High-Gloss Enamel #133.
4. Pittsburgh: Speedhide Int/Ext Gloss Alkyd Enamel, 6-282 Series.
5. P & L: Effecto Enamel.
6. S-W: Industrial Enamel VOC B54Z Series.
7. Tnemec: Series 2H.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until

unsatisfactory conditions have been corrected. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

- B. Coordination of Work:
1. Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 2. Notify the Commissioner about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or providesurface applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- B. Refer to Division 5 for surface preparation, shop priming or galvanizing for steel.
- C. Surface Preparation - General: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
 2. Cementitious Materials: Prepare concrete masonry block, and cement plaster surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if specified by the paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- D. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer, and only within specified limits.

- E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat so that missed areas will be visually apparent.

3.03 APPLICATION - GENERAL

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 1. Some paint colors, surface treatments, and finishes are indicated in "schedules."
 - 2. Provide finish coats that are compatible with primers used.
 - 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as specified by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 - 4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 - 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 - 6. Surfaces which will be inaccessible after erection of other elements shall be painted prior to the installation of the obstructing item. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 - a. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 - b. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - c. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
 - d. Sand lightly between each succeeding enamel coat.
 - e. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coats to permit proper drying and according to manufacturer's directions. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's specified spreading rate. Provide a total dry film thickness of the entire system as specified by the manufacturer.

- E. Prime Coats: Before application of finish coats, apply a prime coat of material as specified by the manufacturer to material that is required to be painted or finished and has not been prime coated by others or galvanized. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing. Where the primer is faulty, or has been damaged, and at on-site welded areas the primed surface shall be cleaned (blasted if required) and re-primed.
- F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- G. Completed Work: Match approved samples for color, texture, sheen and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.
- H. To prevent low film thickness, all angles, welds, crevices, external edges, corners, nuts and bolts, shall, for each coating to be applied, be coated once prior to the coating of the whole area. The Contractor shall ensure that the whole surface is covered with paint being applied to all sides of obstructions such as bolts and nuts.
- I. Avoid excessive film build-up which may result in "mud cracking". If such areas do occur they must be blast cleaned in accordance with this specification and repaired.
- J. Paints should be applied in the correct sequence at the required spreading rate to enable the coating system to perform the function for which it was formulated. Full drying time should be allowed between successive coats of paint.
- K. The minimum coating thickness shall be as specified for each paint system and the maximum thickness in any one application must not exceed that recommended by the paint manufacturer.
- L. Recoating: If film thickness is insufficient, or recoating is required for any reason, maximum intervals between successive topcoats shall be in accordance with the manufacturer's recommendations, but in no case shall be more than seven days. If the intervals exceed seven days, the entire surface shall be lightly blasted with a fine abrasive to provide adequate mechanical bond.
- M. Reinstatement of Damaged Topcoats: Where an item which has been partially or fully topcoated is subject to coating damage, the primer surface at the damaged area shall be reinstated as specified above and then topcoated in accordance with the procedures for original topcoating. If the damage is confined to the topcoat only and the primer surface is not exposed, the topcoat shall be lightly brush blasted, cleaned and recoated as for the original topcoat.

3.04 PAINTING OF MECHANICAL AND ELECTRICAL ITEMS

- A. Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- B. Mechanical items to be painted include but are not limited to:
 - 1. Piping, pipe hangers, and supports.
 - 2. Heat exchangers.
 - 3. Tanks.
 - 4. Ductwork.
 - 5. Insulation.
 - 6. Supports.

7. Motors and mechanical equipment.
 8. Accessory items.
- C. Electrical items to be painted include but are not limited to:
1. Conduit and fittings.
 2. Junction Boxes.
 3. Pull Boxes.
- D. After cleaning of surfaces, remove all traces of rust, millscale, corrosion, and loose or flaky paint with power or hand tools.

3.05 FIELD QUALITY CONTROL

- A. IDOT reserves the right to invoke the following test procedure at any time and as often as IDOT deems necessary during the period when paint is being applied:
1. The Contractor shall engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project shall be taken, identified, sealed, and certified in the presence of the Contractor.
 2. The testing laboratory shall perform appropriate tests for the following characteristics as required by IDOT:
 - a. Quantitative materials analysis.
 - b. Abrasion resistance.
 - c. Apparent reflectivity.
 - d. Flexibility.
 - e. Washability.
 - f. Absorption.
 - g. Accelerated weathering.
 - h. Dry opacity.
 - i. Accelerated yellowness.
 - j. Recoating.
 - k. Skinning.
 - l. Color retention.
 - m. Alkali and mildew resistance.
 3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible, at no cost to the Commissioner.

3.06 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, blasting material, and other discarded paint materials from the site.
- B. Oily or paint-filled rags or waste and other combustible materials shall be the responsibility of the Contractor. The Contractor shall dispose of these materials in metal containers with tight fitting lids on a daily basis. The proper disposal of these materials is the responsibility of the Contractor.
- C. Prior to final completion and acceptance, the Contractor shall examine all painted and

finished surfaces and retouch or refinish as necessary to leave all surfaces in acceptable condition.

- D. Upon completion of work, the Contractor shall remove all paint and varnish spots from floors, glass and other surfaces and remove all rubbish and accumulated materials of whatever nature from premises. Work areas shall be left in a clean, orderly and acceptable condition.

3.07 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.08 INTERIOR PAINT SCHEDULE

- A. General: See Finish Schedule on the drawings.

3.09 MECHANICAL AND ELECTRICAL ITEMS

- A. The coating system shall be suitable for long term protection; expected life to first maintenance to be 15 to 20 years. The coating system and dry film thickness shall be suitable for the required performance considering the expected service life and environmental condition. Paints shall be applied so that an even film of uniform thickness, tint and consistency covers the entire surface, and is free of pin holes, runs, sags, bubbles, dry spray, cracking or other imperfections.
- B. Steel plate and all rolled steel sections including brackets and supports shall be given an application of cold phosphatising compound before being prime coated.
- C. Prime Coat: Inorganic zinc silicate or red zinc chromate primer, 3 mils nominal dry film thickness.
- D. Intermediate and Top Coat: High-build epoxy/High build epoxy and epoxy enamel (interior); High build polyurethane (exterior).

END OF SECTION 09 90 00

SECTION 09 90 10
CLEANING AND PROTECTIVE COATINGS
OF EXISTING SURFACES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Unless noted otherwise, existing surfaces to be re-used shall be cleaned of old paint prior to re-coating. The Contractor should assume that all the existing coatings contain lead or other heavy metals unless otherwise noted in the documents, and all residue generated during the cleaning process shall be fully contained and properly disposed of. The Contractor shall determine if coatings in certain areas do not contain lead or other heavy metals by means of chemical and physical analyses approved by the Authority.
- B. The Contractor shall furnish all labor, materials, insurance, testing and cleaning equipment, including tools, receptacles, scaffolding, material for enclosures, and other necessary apparatus required to contain, clean, dispose of all lead-base and non-lead-base paint and other material on structural steel, castings and other designated elements of the track structure, station, platform, canopy, and other designated elements of the rapid transit structures and facilities of the CTA rapid transit system at the locations specified herein to remain or be reused. This would include all elements of the historical stations designated to be re-used. Surface preparation, protective coating and top coating paint material shall be furnished and installed by the Contractor.
- C. Elements that are to remain or be reused that will require cleaning and protective coatings include, but are not limited to, the following:
1. All surfaces and edges of all steel surfaces of the structure members of the upper level Peoria Street Station structure members and stairs.
 2. All steel surfaces and edges of the platform level structure members at the Peoria Street Station.
- D. Definitions:
1. The term "structure" as used herein shall include all structural members of the upper level station structure and platform level structure, such as tube steel, structural tees, channels, bent plates, channels, stairs and railings, beams etc., continuous from beginning to end of the Project.
 2. "Abatement site" means the location of the site where the lead abatement operations are being performed by the Contractor.
 3. "Containment area" means the area established by the Contractor at an abatement site to demarcate the area where operations are being performed to abate lead.
 4. "Final clearance" means the approval given by an independent engineer after the lead abatement operations are completed.
 5. "Lead" means all lead, lead-based products, lead-containing materials, lead-containing waste, or any goods, products, or structures containing lead, which are the subject of the lead abatement operations.
 6. "Lead abatement operations" means operations performed by the Contractor to abate lead-based products, lead-containing soil and/or water, or those operations

performed on the abatement site by the Contractor which are incidental to any of the above.

7. "Scheduled project" means lead abatement operations being performed by the Contractor at an abatement site commencing with the beginning date and terminating upon the completion date of the lead abatement operations, as reported on an "Application For Lead Abatement Specific Project Certificate of Insurance" for which the issuance of a Certificate of Insurance to the Contractor has been authorized by the Insurer.
8. "DFT" means dry film thickness.

D. Related Sections: The following sections contain requirements that relate to this Section.

1. Section 05 10 30: Structural Steel.
2. Section 09 90 00: Painting.

1.03 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards and Specifications:

1. The latest editions of Codes and regulations of all local, state and federal jurisdictional authorities.
2. Steel Structures Painting Council (SSPC).
3. Society of Automotive Engineers (SAE): J 872, and grit values.
4. Environmental Protection Agency protection of Environment - 40 CFR
5. Occupational Safety and Health Standards for the Construction Industry (29 CFR Part 1926) with particular emphasis on Lead, Part 1926.62. Also, if applicable:

Inorganic Arsenic	29CFR 1910.1018
Cadmium	29 CFR 1926.1127
Chromium	29 CFR 1920.55

6. Illinois Department of Transportation (IDOT), 2002.
7. Illinois Department of Public Health Lead Poisoning Prevention Code, 77 IL ADM, Code 845.
8. City of Chicago Municipal Code, 11-4-2180.

B. Lead Abatement Liability Insurance: With respect to the coverage afforded under the lead abatement liability insurance policy, it is agreed that the following Paragraphs 1 through 9 are conditions precedent to coverage and are added to Contractors/Subcontractors Insurance Requirements, Part 3, Article 2 of the Contract.

1. Records: The Contractor is required to maintain written records for every scheduled project to show compliance with Conditions 2 through 9 below and to send the Authority, its designee and the Insurer copies of these records at such times as the Insurer may request
2. Employee and Environmental Monitoring:
 - a. Initial employee air monitoring must be conducted on each project to characterize the airborne lead (and also arsenic, cadmium, and/or chromium, if applicable) exposure of workers involved in different functions during abatement. Additional employee monitoring shall be conducted periodically throughout the project, and whenever abatement methodologies or job functions change. Frequency of monitoring shall be as dictated by governing regulations and/or OSHA.
 - b. Environmental monitoring shall consist of continuous ambient air monitoring outside containment to demonstrate effectiveness of containment unit.

- c. The Contractor shall hire a third-party consultant (independent of the Contractor), for monitoring environmental issues and all employees. An Illinois Department of Public Health (IDPH) licensed lead inspector shall collect all samples.
3. Sampling Requirements:
- a. Pre-abatement, abatement and final clearance sampling shall be conducted by an independent third-party consultant on every containment (including paint chip, wipe, air, soil and sediment sampling as deemed appropriate by the Authority). Soil, water and sediment sampling shall be conducted whenever soil or water is in the immediate vicinity of the abatement site.
 - b. A lead abatement project shall be deemed to be in compliance if:
 - 1) Lead levels on horizontal surfaces shall be below 200 micrograms per square foot except floor areas shall be below 50 micrograms per square foot. All soil areas shall be below 400 parts per million (ppm).
 - c. Methods of Sampling and Analyses:
 - 1) Employee air monitoring shall be conducted in accordance with National Institute for Occupational Safety and Health (NIOSH) analytical Method 7400 for Lead, Method 7048 for Cadmium, Method 7300 for Chromium, and Method 7900 for Arsenic as appropriate.
 - 2) Ambient air monitoring shall be conducted in accordance with 40 CFR Part 50, Appendix G, "Referenced Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air" and Appendix J "Reference Method for the Determination of PM10 in the Ambient Air". Results shall be available within 24 Hours of collection until a base line level is achieved.
 - 3) All other sampling shall be conducted in accordance with accepted methodologies approved by the Authority.
 - 4) Use analytical methods for determination of lead content in paint (and other heavy metal) that are acceptable to the Authority. TCLP Waste Characterization sampling is not an acceptable method to determine the presence of lead in the structure's existing coatings.
 - 5) Soil, sediment, and groundwater sampling shall be conducted using the ASTM method SW-846 ^ATest Methods for Evaluating Solid Waste[@].
 - d. Analysis of Samples: All employee air samples shall be analyzed by an independent American Industrial Hygiene Association (AIHA) accredited laboratory, hired by the Contractor. All ambient air, wipe, soil, and other lead samples shall be analyzed by a qualified independent laboratory which holds the AIHA, American Association of Laboratory Accreditation (AALA) or other appropriate accreditation, or which is a contractor for inorganic analysis in the U.S. EPA Contract Laboratory Program (CLP).
4. Blood Lead Monitoring: Blood lead and Zinc Protoporphyrin (ZPP) level sampling and analysis in the form of blood sampling shall be made available to each employee exposed to lead above the OSHA action level.

- a. Monitoring of every site worker shall be conducted before the start of each project to establish baseline levels, at least every two months for the first six months thereafter until the project is completed, and upon termination of work from this project.
 - b. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician. Analysis of samples shall be performed by a laboratory using OSHA approved methods.
 - c. Employees whose blood lead levels exceed 40 mg/dl shall be temporarily removed from the work area. A follow-up blood test shall be provided within two weeks after the employer receives the results of the first blood test. Employees exceeding 40 mg/dl shall be sampled at least every two months. This frequency shall continue until two consecutive blood samples and analysis indicate a blood level below 40 mg/dl.
5. Hygiene Facilities and Practices:
- a. Eating, drinking, smoking and applying cosmetics are not allowed in the work area. Any person leaving the work site or work area shall rinse his or her mouth with potable water and wash hands and face thoroughly before eating, drinking, or smoking. All individuals shall wash or shower before leaving the work site or work area at the end of a shift or at the end of the work day.
 - b. A decontamination facility equipped with shower(s), lavatory(s), and potable water supply shall be provided on every job site. All hygiene procedures outlined in OSHA 29 CFR 1926.62 shall be followed unless the Contractor can demonstrate to the satisfaction of the Authority that the lead PEL (50 ug/m³) shall not be exceeded and upon approval of the Authority.
6. Signs: Signs, in accordance with 29 CFR 1926.62, including warning signs for other desired requirements stating "Caution, Lead Hazard - Keep Out" or "Warning - Lead Work Area - Keep Out", are to be utilized to identify encased, encapsulated or enclosed lead to warn others of the hazard. In addition, plans identifying the location of encased, encapsulated or enclosed lead shall be prepared and submitted to the Authority with written notice of the hazards that may arise due to activities that may disturb or destroy the encasement, encapsulant or enclosure.
7. Conformance with Regulations: All lead abatement operations must conform to 29 C.F.R. 1926.62 and all other applicable federal, state, and local laws and regulations. In the event of a conflict between regulations and guidelines, the stricter regulation or guideline is to be followed, provided this will not result in a violation of the regulations.
8. Containment Negative Pressure: All lead abatement operations, including clean-up, shall be conducted in containment under a negative differential air pressure as described in Section 3.03 A of this specification.
9. Personnel Training: All employees working on this project shall have completed the Illinois Department of Public Health (IDPH) approved Lead Workers Training Program and receive training as specified in 29 CFR 1926, 40 CFR 265 and any other applicable federal, state and local codes or regulations and pass the examinations administered at the conclusion of the courses. If the initial classes were taken more than three years prior to the project, the lead worker must submit a current refresher class certification.
- C. Coordination with other Agencies or Entities:
1. Illinois Department of Transportation (IDOT) and local municipalities.
 2. CTA forces working in the project area.

3. Other contractors working in the project area.

D. Permits:

1. Contractor must obtain all required local permits and approvals. Work in the City of Chicago requires a permit and notification to all residents and businesses within 75 feet of the abatement project.

1.04 SUBMITTALS:

A. Submit the following for approval by the Authority in accordance with the General and Special Conditions and with the additional requirements as specified:

B. Coating Materials

1. The coating manufacturer's current printed technical data for the proposed coatings. The technical data submittal shall include all coating properties pertinent to the specifications outlined in Sections 2.2 and 2.3 as well as material safety data sheets for all coatings, solvents and any other material being used by the Contractor and Sub-Contractors on this project.
2. The coating manufacturer's current printed instructions for application of the coatings.
3. Field History of Epoxy-Mastic Coating: Submit documentation by the coating manufacturer verifying successful use of the epoxy-mastic coating in the field. The coating shall have been successfully used on at least ten (10) projects which required at least 100 gallons per project. The performance history shall also be for a minimum of three (3) years in a similar environment as the intended use.
4. Warranty: Provide a written warranty, in a form acceptable to the Authority, from the coating manufacturer, countersigned by the applicator, stating that the system provided is as specified and any defects due to materials and/or workmanship shall be repaired and/or replaced at no cost to the Authority for a period of three (3) years from time of final acceptance by the Authority.
5. The coating manufacturer's certification that the products in a multi-layer coating system are appropriate for the intended use, and are compatible with each other and with project substrates.
6. Color Samples: Submit a color chip chart from the coating manufacturer for selection of colors for topcoat. The Authority shall prepare a schedule locating color placement in the project. Up to five (5) colors may be selected.
7. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Resubmit until required gloss, colors, and textures are achieved.

C. Hazardous Waste and Pollution Control:

1. Documentation verifying that arrangements for the transport and disposal of special waste (including hazardous waste), contaminated materials and supplies have been made, including the name and location of the disposal site, and a copy of the handling procedures. Certification that all these elements comply with all local, state, and federal laws and regulations in effect at the time of execution of the Contract shall be required in writing.
2. The Contractor shall furnish proof that employees have successfully completed a training program as specified in 29 CFR 1926, 40 CFR 265, and all other applicable federal, state and local codes and regulations.
3. Submit a copy of the application to the Illinois EPA or applicable local and state agency for permission to haul special waste (including hazardous waste) to the disposal site. The Contractor shall submit for the Authority's approval the name,

- address, phone number, state and federal operating permit ID numbers for each special or hazardous waste transporter and disposal facility to be used on this project. A list of CTA approved disposal sites can be obtained from the Authority.
4. The Contractor shall provide completed manifests ready for signature to the Authority. The Manager of Health and Environmental shall sign the manifests.
 5. Provide copies of all abrasive blasting permits issued by local agencies.
 6. A copy of the Site Specific Safety and Health Plan for lead paint removal developed for this project shall be submitted two weeks prior to the start of sandblasting. This plan shall be approved by the Authority prior to the start of sand blasting. The Site Specific Safety and Health Plan shall cover all site worker's activities for lead abatement and application of new coatings and shall include as a minimum: work objective, personnel protective procedures by task and zone, work hazards, project organizational structure, employee training, medical surveillance program, work procedures and practices, air monitoring and environmental sampling protocol, decontamination procedures, site emergency plan, and all regulations applicable to this project.
 7. A copy of the Contractor Contingency Plan shall be submitted two (2) weeks prior to the start of the work. The plan shall follow the Illinois Department of Transportation plan for lead removal projects entitled: "Hazardous Waste Contingency Plan for Lead Based Paint Removal Projects" (IDOT Form 5843I). Contractor shall also submit to the Authority copies of notification letters to local police, fire departments and hospital facilities to inform them of the project. Projects within the City Limits of Chicago require notification to all businesses and residents within 75 feet of all work areas.
 8. The written air monitoring program shall be submitted two (2) weeks prior to the start of the work and include the name(s) of the air monitoring technician(s) appointed and his (their) qualifications, types of equipment and materials proposed, and the testing laboratory proposed. An independent third-party consultant shall conduct this written program and all employee and environmental air monitoring.
- D. Lead Abatement Plan: A written job specification for the lead abatement plan shall be prepared and submitted two (2) weeks prior to the start of the work. This plan must be approved by the Authority prior to the start of the work.
1. This plan shall include drawings of the arrangement and type of material to be used for the containment, size of the containment, hygiene facilities, location of the negative air machine, and procedures for the collection, temporary storage, transportation and disposal of the blasting debris.
 2. All details for the Lead Abatement Plan shall be submitted to the Authority in the form of Drawings and Specifications and shall be approved prior to the start of work. The plan should provide detailed information regarding the method of containment, the containment structure design, method of recycling blast abrasive, the hazardous waste temporary storage and disposal system, equipment specifications, and all other pertinent information related to the pollution control plan. The decision of the Authority as to the acceptability of the plan shall be final. However, approval of the plan by the Authority shall in no way relieve the Contractor of his obligation to supply and maintain a pollution control plan in full compliance with this Specification and all government agency regulations.
- E. Employee Medical Qualification Forms: Submit certification of employee medical examination by a qualified occupational physician and respirator fit testing results for each employee who works on this project. These documents shall be current, within one year from the commencement of this project. No employee shall be permitted to operate on this project unless this documentation has been submitted and copies kept at the site.

- F. All of the above shall be in full compliance with all laws, regulations, etc. in effect at the time of Contract execution.
- G. Test Methods: Prior to beginning lead abatement work, the Contractor shall submit for approval by the Authority, test methods for determining the presence of lead and the heavy metals arsenic, cadmium and chromium, and their content in existing paint.
- H. Abrasive Certifications: Submit manufacturer's written certification that abrasive blasting materials comply with specifications. Independent laboratory sample analysis shall be conducted to determine if the new abrasive contains lead, arsenic, cadmium and/or chromium.
- I. Enclosure: Submit Blast Enclosure Construction Details and Method of maintaining Negative Pressure.

PART 2 PRODUCTS

2.01 ABRASIVE FOR BLAST CLEANING:

- A. Disposable, clean, non-conductive abrasive.
 - 1. Commercially available crushed slag capable of producing a blast cleaned surface with a profile of 2-3 mils and with a minimum of residual embedment.
- B. The abrasive shall be non-conductive in the vicinity of the existing wood ties or power distribution cables which are to remain. Non-conductive abrasive shall not be reused.
- C. Abrasive type and size shall ensure maximum allowable profile height for a particular coating application. The abrasive should be clean and dry and selected as appropriate. Profile height is to be measured by an Elecometer or similar Surface Profile Gauge.
- D. Calcium Silicate Abrasive Additive for lead abatement (Optional):
 - 1. Particle size distribution of at least 95% greater than 50 mesh and less than 12 mesh.
 - 2. Bulk density of greater than 80 pounds per cubic foot and less than 100 pounds per cubic foot.
 - 3. Hardness greater than 60 on the Mohs scale.
 - 4. Must be capable of rendring leachable lead in the untreated spent abrasive wastes from up to 100 mg / 1 to less than 5.0 mg / 1 (non-hazardous) according to the TCLP.
 - 5. Must not be a hazardous material under the US OSHA Hazard Communication Standard.
 - 6. Must not create an additional work place health hazard as defined by the US OSHA Hazard Communication Standard.
 - 7. Must be approved for use without RCRA (or equivalent) treatment permit by State Environmental Officials.
- E. All equipment required for blast cleaning operations including air compressors shall be supplied and maintained by the Contractor. Compressors shall be of adequate size and in good repair. Compressed air shall be free of oil and water and shall have a minimum working pressure of 180 inches of mercury.
- F. Surface salts: Where a surface shows discoloration within a short time after blast cleaning, this is an indication that the surface contains salt which will be detrimental to the paint coating. Under these circumstances, the surface shall be thoroughly washed

with fresh water, dried and re-blasted. If necessary, the procedure may need to be repeated for as many times as are necessary.

2.02 GENERAL FOR COATINGS

- A. The coating system described herein provides for a self-priming, two-part aluminum pigmented epoxy mastic protective coat and an aliphatic acrylic urethane top coat. Contractor shall furnish all coating materials. The Authority reserves the right to select the colors (Federal Standard Colors).
- B. The same manufacturer shall supply all products in a multi-layer coating system. The coating manufacturer shall certify that the products are appropriate for the intended use and are compatible with each other.
- C. All coatings used for this project to be lead-free.

2.03 PROTECTIVE COAT-EPOXY MASTIC

- A. Description: Self-priming, two-component, modified epoxy mastic, aluminum pigment. The epoxy mastic shall be a one (1) coat, high-build complete protective coating system certified by the manufacturer as being appropriate for use over marginally prepared rusted, pitted and coated steel surfaces. It shall be supplied as two-part material with a one-to-one volume mix ratio, and shall be well ground and not caked, skinned or substantially settled in the container.
- B. Composition
 - 1. Pigment: The pigment shall be leafed aluminum. Secondary pigments shall be rust-inhibiting and adhesion-promoting types.
 - 2. Vehicle: The vehicle shall be of the epoxy-type modified with bitumen like substance. The curing agent shall have suitable insensitivity to moisture to allow trouble-free application during normal humidity conditions.
 - 3. The epoxy mastic shall contain 90% minimum solids by weight, tested according to ASTM D1644 modified to a dry time of seventy-two (72) hours at 100 degrees F rather than three (3) hours at 105 degrees F.
 - 4. The shelf life of the epoxy mastic components shall be no shorter than twelve (12) months, so that no caking of fillers, skins or gelatin occurs.
 - 5. Viscosity: Component A and Component B shall be mixed viscosity of 110-140KU, at 75 Degrees F plus or minus 2 degrees F.
 - 6. The Volatile Organic Compounds (VOC) shall not exceed 340 g/L (2.8 lb/gal) as applied when tested according to ASTM D 3960.
- C. Mixing: No partial containers shall be mixed and mixing shall be accomplished by the use of air driven stirrers.
- C. Properties of Mixed Paint
 - 1. The epoxy mastic shall air cure at temperatures of 75 Degrees F or above to a hard and tough film within five (5) days by evaporation of solvent and chemical reaction. At 75 Degrees F, it shall be dry to the touch within twenty-four (24) hours, and able to receive foot traffic within forty-eight (48) hours.
 - 2. The pot life of the epoxy mastic shall not be shorter than four (4) hours at 75 Degrees F, un-thinned.
 - 3. The mixed paint weight per gallon shall be 10.2 pounds minimum at 75 Degrees F plus or minus 2 Degrees F.
 - 4. Film Build: The catalyzed mixture, thinned 10% by volume with the manufacturer's recommended thinner, shall be capable of being applied at 10

mils wet film thickness without exhibiting runs or sags.

- E. Test Panel Preparation: the test panels shall be steel, having dimensions of 2" x 5" x 1/8" or as otherwise required by ASTM D 609 specification. The panels shall have coating surfaces prepared by abrasive blasting in accordance with SSPC-SP-5, White Metal Blast Cleaning, with a surface profile of 1-2 mils after which they shall be exposed to Midwest weather for thirty (30) days so that a uniform rusting occurs. They shall then be hand-cleaned with a wire brush in accordance with SSPC-SP-2 specification. Test panels shall then be coated and cured with epoxy mastic as follows: The epoxy mastic shall be spray applied to the steel panels at 5 mils dry film thickness in one (1) coat. The coating shall be cured as recommended by the manufacturer. Unless otherwise noted, panels shall then be scribed down to the substrate metal with an "X" of at least two (2) inch legs prior to being subjected to resistance testing.
- F. Test Requirements: The epoxy-mastic manufacturer shall provide test data acceptable to the Authority demonstrating that the epoxy-mastic coating system has been subjected to, and has successfully performed in testing equal in severity to the following tests:
1. Flexibility Test: ASTM D552. The panel shall be sandblasted in accordance with SSPC-SP5-63 Specification.
 2. Temperature Cycling Test: ASTM D2246 (15 cycles).
 3. Weathering Resistance Test: ASTM G53 (1000 cycles).
 - a. The coated and scribed panels shall then be exposed to ultra-violet and condensation exposure as outlined in the specification for the total exposure period.
 - b. Upon examination after 1000 hours of exposure, the panels shall be unaffected except for discoloration of the epoxy-mastic coating. There shall be no blistering, softening or visible rusting on the coating beyond 1/16" from the center of the scribe marks.
 4. Fresh Water Resistance Test
 - a. The coated and scribed panels shall be immersed in fresh tap water at 75 Degrees F. plus or minus 5 Degrees F.
 - b. Upon examination after thirty (30) days immersion, the panels shall be unaffected except for discoloration of epoxy-mastic coating, there shall be no blistering, softening or visible rusting on the coating beyond 1/16" from the center of the scribe marks.
 5. Salt Water Resistance Test
 - a. The coated and scribed panel shall be immersed in 5% sodium chloride solution at 75 Degrees F. plus or minus 5 Degrees F. for a period of 30 days.
 - b. The panels shall be unaffected except for discoloration of the epoxy-mastic coating upon inspection after 7, 14, and 30 days. There shall be no blistering, softening or visible rusting on the coating beyond 1/16" from the center of the scribe marks. The sodium chloride solution shall be replenished after each examination.
 6. Salt Fog Resistance Test
 - a. The coated and scribed panels shall be tested in a salt fog cabinet using 10% synthetic sea salt solution.
 - b. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16" from the

center of the scribed marks.

G. Packaging and Labeling

1. The epoxy-mastic coating shall be packaged in two (2) containers, labeled Part A and Part B. The components shall be packaged in such proportions that the Part A when mixed with the Part B will yield ten (10) gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the manufacturer or brand name of the paint, the batch or lot number and the date of manufacture. No partial containers shall be mixed and mixing shall be accomplished by the use of air driven stirrers.
2. The label on the vehicle container shall also include complete instructions for the use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

H. The following, or equal products approved by the Authority, are acceptable for the protective coating material:

1. Carboline – Carbomastic 15
2. Valspar – Alumapoxy
3. Porter Magnamastic 7900
4. Steelcote – Steelmastic 168
5. Sherwin-Williams – Epoxy Mastic Aluminum II

2.04 TOP COAT

- A. Aliphatic Acrylic Urethane, 2 mils minimum dry film thickness, for the purposes of ultraviolet protection and aesthetics. Color shall be high gloss CTA colors matching Color Numbers of the Federal Standards or such colors as designated by the Authority. The Authority may select up to five (5) colors for various locations and elements. Urethane shall have the same field history as required in 1.04, B, 3.
- B. The following, or equal products approved by the Authority, are acceptable for the protective coating material:
 - 1. Carboline – No. 134
 - 2. Valspar – Mobilthane HB
 - 3. Porter - Hythane
 - 4. Steelcote – EPO – LUX 595
 - 5. Sherwin-Williams – Corothane II
 - 6. PPG

PART 3 EXECUTION

3.01 GENERAL

- A. Work shall be conducted over contiguous work areas to permit systematic and continuous cleaning and coating operations.
- B. Provide the necessary equipment and operator, which may include truck-mounted manlifts, bucket trucks or other approved equipment suitable to the Engineer, which will permit the Authority to inspect the cleaning and coating operations, both inside and outside of the containment. The equipment shall be in good, clean and safe working condition at all times, and shall be available for the Authority's use at all times, including night and weekend work, whenever work is performed.
- C. Properly protect all adjacent surfaces not to be cleaned and refinished including walls, glazing, gaskets, caulking, fixtures, etc. from damage during the cleaning and finishing operations with masking and materials that will not deteriorate during the cleaning operations.
- D. Provide intrinsically safe artificial lighting in areas where natural illumination is inadequate, as determined by the Authority, to allow proper cleaning, inspection, and painting. Illuminance surrounding blasting and painting work shall be at least 30 foot-candles. Illuminance of the working platforms, access and entry shall be at least 20 foot-candles.
- E. At no time during the execution of the work shall the Contractor employ less than six (6) workers at one location without approval of the Authority.
- F. No blasting work shall be conducted when the steel substrate surface temperature is less than 5 degrees F. above the dewpoint.
- G. All cleaned surfaces to be coated shall be inspected, in accordance with the inspection requirements outlined in the Contractor's Quality Program as specified and accepted by the Authority before any coating is applied.

3.02 CLEANING OF SURFACES:

- A. General: The Contractor shall determine if coatings in certain areas do not contain lead by means of chemical and physical analysis subject to approval by the Authority. Unless the existing coatings are determined to be non-hazardous or indicated to remain, one hundred percent (100%) of all surfaces to be coated shall be cleaned by the appropriate method as described below and as approved by the Authority.
- B. The Contractor shall completely remove all existing coatings unless indicated otherwise. The Contractor shall assume that all existing coatings contain lead, arsenic, cadmium, and/or chromium unless determined otherwise. Laboratory analysis of the samples is required and all residue generated during the cleaning process shall be fully contained and properly disposed of as hazardous waste.
1. The Contractor shall provide a schedule of specific existing surfaces and their respective method of cleaning proposed, for the Authority's approval.
 2. Prior to blast cleaning, all visible grease and oil shall be cleaned and removed with a solvent acceptable to the Authority in accordance with SSPC SP 1.
 3. Dry abrasive blast cleaning shall be used for all cleaning methods, to class 2 2 (Near White metal blast cleaning). The Contractor shall use proper blasting equipment and use oil-free and moisture-free compressed air.
 4. Particular attention shall be paid to joints, angles, pits and weld areas to ensure that the treated surface is brought to the standard required.
 5. After blasting, all dust and loose matter shall be removed from the surfaces. All dust and grit shall be removed from pockets and corners using dry compressed air. If grease or oil are still present, these areas shall be spot cleaned with solvent. The steel shall not be allowed to rust or be contaminated in any way before coating. Rust formed after cleaning shall be removed by re-blasting prior to coating. All surfaces shall be thoroughly cleaned and dried to the satisfaction of the Authority and the coatings applicator before any coating is applied. Operators shall wear clean gloves when handling the steel.
 6. All work cleaned on one day shall be prime coated on that day before the dew point is reached and before any contamination or discoloration of the surface can take place. However, in any case, coating shall be applied within twenty-four (24) hours of blast cleaning, unless directed otherwise by the Authority. Any blasted area not coated within the above specified period shall be re-blasted to the satisfaction of the Authority before coating application.
 7. The Contractor's representative shall ensure that weather conditions, wind borne dust, non-availability of labor, equipment or paint do not prevent the application of a priming coat within the prescribed period.
- C. Where existing coatings are approved by the Authority to remain, the existing coatings must be secure, in good condition, and determined and approved to be compatible with the new coating system. Where peeling coatings are encountered, the Contractor shall remove the peeling layer in its entirety not only at the peeling locations, but the entire member or surface where ever that layer is detected.

3.03 CLEANING METHODS

- A. Method #1 Cleaning (dry abrasive blasting in enclosure, containment and disposal):
1. Method #1 Cleaning is a method of preparing steel surfaces which is to be in accordance with SSPC-SP 6 and be a visual match when compared to SSPC VIS 1 for SP 6 cleaned surfaces and, when viewed without magnification, shall leave the cleaned surface free of all visible oil, grease, dirt, dust, mill scale, rust, paint and other foreign materials. Generally, evenly dispersed very light discoloration caused by stains of rust, stains of mill scale or stains of previously applied coatings may remain on no more than thirty-three percent (33%) of any

- square inch of the surface. The Contractor shall completely remove all existing coatings. Blast profile shall be 1.0 mil minimum, 1.5 mils maximum.
2. Hazardous waste containment and control procedures shall be utilized for lead-based paint removal.
 3. Rust formed after cleaning shall be removed by re-blasting prior to coating. Dust from blasting shall be removed from cleaned surfaces by brushing, vacuum or blow-off with clean dry air prior to coating.
 4. The maximum time allowed between cleaning and application of prime coat shall be twenty-four (24) hours. Under no circumstances shall steel exhibit visual evidence of rusting before coating regardless of time elapsed.
 5. No blasting work shall be conducted when steel surface temperature is less than five (5) Degrees F above the dewpoint or the relative humidity is above 85%.

B. Method #2 Cleaning (shrouded vacuum blasting without enclosure, lead paint containment and disposal):

1. Method #2 cleaning is a method of preparing steel surfaces using mechanical self containing shrouded vacuum blasting equipment so as to remove and contain the blasting residue and removed paint without need for a separate enclosure. No surface is too blasted if shrouds are not in contact with the steel surface. The prepared surface is to be in accordance with SSPC-SP 6 and be a visual match when compared to SSPC-VIS 1 for SP 6 cleaned surfaces. Cleaning shall utilize mechanical self-containing shrouded vacuum blasting equipment so as to remove and contain the fall-off without need for a separate enclosure. Method #2 Cleaning is a method of preparing steel surfaces which, when viewed without magnification, shall leave the cleaned surface free of all visible oil, grease, dirt, dust, mill scale, rust, paint and other foreign materials. Generally, evenly dispersed very light discoloration caused by stains of rust, stains of mill scale or stains of previously applied coatings may remain on no more than thirty-three percent (33%) of any square inch of the surface. The Contractor shall completely remove all existing coatings. Blast profile shall be 1.0 mil minimum, 1.5 mils maximum.
2. Hazardous waste containment and control procedures shall be utilized for lead-based paint removal.
3. Rust formed after cleaning shall be removed by re-blasting prior to coating. Dust from blasting shall be removed from cleaned surfaces by brushing, vacuum or blown-off with clean dry air prior to coating.
4. The maximum time allowed between cleaning and application of prime coat shall be twenty-four (24) hours. Under no circumstances shall steel be permitted to rust before coating regardless of time elapsed.
5. No blasting work shall be conducted when steel surface temperature is less than five (5) Degree F above the dew point.
6. The Contractor, when authorized by the Authority, may utilize Method #2 Cleaning in lieu of Method #1 Cleaning in order to achieve the project milestones, or at specific locations requiring unrestricted access to adjacent businesses.

- C. Method #3 Cleaning (Wet Abrasive blasting with containment and disposal):
1. Method #3 Cleaning is a method of preparing steel surfaces which, when viewed without magnification, shall leave the cleaned surface free of all visible oil, grease, dirt, dust, mill scale, rust, paint and other foreign materials. Generally, evenly dispersed very light discoloration caused by stains of rust, stains of mill scale or stains of previously applied coatings may remain on no more than thirty-three percent (33%) of any square inch of the surface. The Contractor shall completely remove all existing coatings. Blast profile shall be 1.0 mil minimum, 1.5 mils maximum.
 2. Hazardous waste containment and control procedures shall be utilized for lead-based paint removal.
 3. Rust formed after cleaning shall be removed by re-blasting prior to coating.
 4. After wet blasting, rinse cleaned surface to remove spent abrasives with fresh water to which sufficient corrosion inhibitor has been added to prevent rusting, or with fresh water followed by an inhibitor treatment. Supplement this cleaning by brushing if necessary to remove any residues.
 5. The maximum time allowed between cleaning and application of prime coat shall be twenty-four (24) hours. Under no circumstances shall steel exhibit visual evidence of rusting before coating regardless of time elapsed.
 6. No blasting work shall be conducted when steel surface temperature is less than 5EF above the dew point.
- D. Method #4 Cleaning (Ultra High Pressure Water Wash SSPC-SP12 with containment and disposal):
1. Method #4 Cleaning is a method of preparing steel surfaces which, when viewed without magnification, shall leave the cleaned surface free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Mill scale, rust and paint are considered adherent if they cannot be removed by lifting by a dull putty knife or cracked off by impact a hand chipping hammer.
 2. The standards established by Visual Surface preparation definition WJ-1 and non-visual surface preparation definition SC-1 of SSPC-SP 12 shall be satisfied.
 3. As part of surface preparation, deposits of oil, grease and foreign matter must be removed by ultrahigh-pressure water jetting, by steam cleaning with detergent, by methods in accordance with SSPC-SP 1 or by another method approved by the Authority.
 4. It is necessary to use an inhibitor that prevents rust forming after rinsing.
- E. Method #5 Power Tool Cleaning to Bare Metal (SSPC-SP 11):
1. Power tool cleaning shall remove all old paint, loose mill scale, loose paint with power wire brushes, power impact tools, power sanders or combined methods.
 2. Areas inaccessible for cleaning by power tools shall be cleaned by "Hand Tool Cleaning" as outlined in Method #7.
 3. After power tool cleaning is completed, dust and other loose matter shall be removed from the surface. If grease or oil are still present, these areas shall be spot cleaned with solvent.
 4. Hazardous waste control procedures shall be utilized for lead based paint removal.

- F. Method #6 Solvent Cleaning (SSPC-SP 1):
1. Solvent Cleaning is a method for removing all visible grease, oil, soil, drawing and cutting compounds, and other soluble containments. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
- G. Method #7 Hand Tool Cleaning (SSPC-SP 2):
1. Hand tool cleaning shall be used where applicable; using hand brushing, hand sanding, hand scraping, hand chipping or combined methods to remove loose mill, scale, loose rust, loose paint and other detrimental foreign matter. After hand cleaning is completed, dust and other loose matter shall be removed from the surface. If grease or oil are still present, these areas shall be spot cleaned with solvent.
- H. Method #8 Cleaning (dry Brush-Off Blast cleaning, non-lead-based paint):
1. Method #8 Cleaning is a method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Mill scale, rust, and paint are considered tightly adherent if they cannot be removed by lifting with a dull putty knife. The entire surface shall be subjected to the abrasive blast. The remaining mill scale, rust, or paint shall be tight. When painting is specified, the surface shall be roughened to a degree suitable for the specified paint system. Immediately prior to paint application, the surface shall comply with the degree of cleaning as specified herein. Method #8 Cleaning shall produce a surface condition meeting all requirements of Brush-Off Blast Cleaning (SSPC-SP 7).

3.04 SURFACE PREPARATION

- A. Cleaning Structural Steel: All steel structure defined in this contract to be cleaned shall be cleaned by using Method #1, except as follows:
1. Hand Tool Cleaning (SSPC-SP 2) or Power Tool Cleaning (SSPC-SP 3) may be used as supplement to Method #1 Cleaning for top surface of track stringer, cross girder and top lateral bracing between the track ties and top surfaces of track thru girders.
 2. The Contractor, when authorized by the Authority, may utilize Method #2 or #5 Cleaning as a supplement or in lieu of Method #1 Cleaning at no additional cost to the Authority.
 3. A modified Method #1 Cleaning procedure involving less stringent waste containment and disposal controls may be utilized when the Contractor demonstrates to the satisfaction of the Authority that the coating to be removed does not contain lead, arsenic, cadmium, and/or chromium.
- B. Cleaning Architectural and Miscellaneous Structural Elements: All existing coatings to be removed shall be removed by using Method #1 Cleaning, except as follows:
1. All surfaces not accessible with ladders or requiring access from or above track level may be cleaned using Method #3 (wet abrasive blasting) upon approval by the Authority.
 2. All other Station Architectural Elements may be cleaned using Method #4 (High Pressure Water Wash). The Contractor is responsible for using a filtration system in all drainage areas during all High Pressure Water Wash. In addition, the

Contractor shall employ Cleaning Method #7 (hand tool cleaning) or Cleaning Method #5 (power tool cleaning) or a combination of the two, where required to satisfactorily remove existing coatings and rust.

3. All exterior metal railings adjacent to roadways and on bridges and bridge supports, shall be cleaned using Cleaning Method #1 (dry abrasive blasting with enclosure) or #3 (wet abrasive blasting). The Contractor shall completely remove all existing coatings.
 4. All galvanized metal surfaces shall be cleaned of dirt and grease using cleaning method #6 (Solvent Cleaning) prior to using cleaning method #7 (Hand Tool Cleaning) and cleaning method #5 (Power Tool Cleaning). Extra care shall be exercised with perforated surfaces.
 5. All wooden surfaces shall be thoroughly cleaned using Cleaning Method #7 (Hand Tool Cleaning) and the surfaces shall be sandpapered with coarse, medium, and fine sandpaper to a smooth, even and uniform surface. Remove sanding dust from entire surface using air pressure before first coat is applied.
 6. All painted concrete surfaces shall be cleaned using Cleaning Method #4 (High Pressure Water Wash). The Contractor is responsible for using a filtration system in all drainage areas during all cleaning operations.
- C. Test Area: The Contractor shall, at the Contractor's own expense, clean minimum two-foot by two-foot area of the structure for each cleaning method to be utilized. After inspection and acceptance of the cleaned sample by the Authority, the sample shall become the standard for the remainder of this project. The Contractor shall, immediately upon acceptance, provide a clear protective coating to preserve these samples in their conditions as approved. Upon completion of the project, the test area shall be re-blasted and coated in accordance with this Specification.
- D. Removal and Restoration of Attachments: Prior to commencement of cleaning work, station signs, advertisements and other attachments, including traffic and street lights that interfere with cleaning operations shall be removed by the Contractor without damage and stored in locations approved by the Authority. The Contractor shall be responsible for inventorying, storing and protecting all removed items. Upon completion of the coating work, only such items designated by the Authority shall be reinstalled by the Contractor; all other items shall be delivered to the Authority's storage location as designated by the Authority.
- E. Any adjacent surfaces, railroad ties, wires, cables or other appurtenances that must remain in close proximity to blast cleaning or subsequent coating operations shall be suitably protected by the Contractor to avoid damage from these operations. These items shall not be painted. Contractor will be held liable for any damage done to cables, wires or other appurtenances that remain in close proximity.

3.05 HAZARDOUS WASTE DISPOSAL AND POLLUTION CONTROL:

- A. Containment:
1. As a minimum requirement, the Contractor shall completely enclose the structure being blast-cleaned during all blasting operations and maintain the enclosure at a negative pressure relative to ambient of 0.3 inches water column. Negative pressure relative to ambient of 0.3 inches water column shall be maintained throughout the enclosure. The Contractor shall confirm daily with a manometer that the negative pressure requirement is maintained throughout the enclosure. The enclosure shall be constructed of a rigid support with positive joint seal. The material used as a cover shall be impermeably equivalent to 6-mils-thickness of polyethylene. A clearly marked, securable opening for ingress and egress shall be provided having minimum dimensions of 2' x 6'. The negative pressure

- system shall use HEPA filters and shall operate continuously, 24 hours a day, at the start of the lead abatement work through clean-up.
2. The blast enclosure shall have a complete ground cover which shall be sealed to the side and end closures to prevent any leakage of contamination. The ground cover shall be non-permeable, shall withstand vehicle movement and not tear by shoveling/scooping or other means of cleaning the waste. Plastic covers are not acceptable within 12 inches of any item which will be sandblasted.
 3. The Contractor shall thoroughly clean the interior of the blast enclosure at the end of each work day and properly handle all waste as herein specified. Dust collected on the floor following abrasive air blasting shall not be removed by blowing with compressed air, brushing, brooming, or by any other method that would re-suspend residues in the air. All dust and residue generated during the cleaning process shall be removed by HEPA vacuuming equipment.
 4. All air exhausted from the enclosure to create a negative pressure within the enclosure shall be filtered to remove all hazardous and other particulate matter, in full compliance with all regulatory requirements of all governmental agencies.
 5. All rigid elements of the enclosure shall be designed to sustain the maximum anticipated wind forces per Chicago Building Code Section 13-52, latest edition, for the period during which they will be maintained.
 6. The Contractor shall be responsible for maintenance of the physical and structural integrity of the blast enclosure at all times of operation and during off hours. Any cracks or holes that may occur during the course of the work shall be repaired immediately. Improper construction or maintenance of the containment enclosure resulting in visible clouds of dust outside the containment, or particulate in the air above EPA allowable limits, will be considered unacceptable. The Contractor shall immediately remove or clean any dust or residue which is found outside of the containment.
 7. The Contractor shall appoint personnel to inspect and maintain the enclosure at all times of the operation.
 8. The Authority will have the right to stop the progress of work if the Contractor fails to maintain a sound enclosure or is found in violation of any safety rules, including safety rules of the Authority or of the site specific health and safety plan. No time extensions will be given for any lost time.

B. Disposal:

1. Waste materials shall be contained in receptacles approved by U.S. Department of Transportation (49 CFT) for the classification of waste involved. All containers of waste shall remain covered at all times except when adding waste.
2. All blasting residues shall be collected daily and deposited in all-weather containers supplied by the Contractor as temporary storage. Blast residues shall be collected and transferred carefully and shall not result in suspension of residues in air or contamination of surrounding surfaces. No residues shall remain on surfaces overnight. The all-weather containers shall meet the requirements for the transportation of hazardous materials. At a minimum the containers shall be equipped with liners and have a tarpaulin cover. All containers shall be approved by the Authority prior to use on the site.
3. Comply with all methods and procedures required by governing agencies for the temporary storage, transport and disposal of all waste.
4. Provide the Authority with the Generator's copy of the manifests for disposal of all waste removed from the site. All waste transportation shall be provided by a licensed special waste hauler. When completing the Uniform Hazardous Waste Manifest for special/hazardous waste, Boxes 1,3 and B should be completed as follows: (1) ILD 005532205; (3) Chicago Transit Authority, 567 W. Lake Street, Chicago, IL 60661; (B) 0316005915.
5. The containers used for temporary storage and transport of the special waste, including hazardous waste, shall be managed in accordance with 40 CFR Part

265 Subpart I entitled "Use and Management of Containers". The containers shall be inspected on a daily basis.

6. Hazardous abrasive blast/paint debris: The Contractor shall conduct TCLP analysis for lead, arsenic cadmium and chromium to determine if waste generated is hazardous. Waste shall be stored off-site prior to land disposal in accordance with the treatment standards set forth in 40 CFR 26D.
7. Non-hazardous abrasive blast/paint debris: The Contractor shall test existing coatings, by methods approved by the Authority, to verify that they do not contain lead. For these areas, the Contractor shall propose an alternate method for disposal to be approved by the Authority and its designee.
8. The Contractor shall make arrangements to have other special waste, such as used paint solvent, paint cans and liners, and contaminated personal protective equipment (PPE) which it generates, transported to the Contractor's facility at the end of each day of which the waste is generated. The Contractor shall not combine solvents, PPE or any other hazardous or non-hazardous waste with the blast residue waste. All waste streams must be tested prior to transporting to avoid illegal transportation and storage of hazardous waste materials.
9. The containers used for temporary storage and transport of the waste shall be placed within the enclosure or within a maximum distance of no more than 10 feet from the enclosure area in which work is being performed.
10. The Contractor shall collect and filter all contaminated water for power washing, steam cleaning, hygiene purposes, laundering of clothing if done on site, and cleanup activities. Filter visible paint chips and particulate from the water prior to placing it into the containers. Test the water for total toxic metals and provide ample filtration until the water is not classified as hazardous. Conduct the necessary laboratory testing as described above.
11. Make disposal arrangements with an Authority approved disposal facility.

C. Protective Equipment:

1. The Contractor shall provide and require all employees to wear all personal protective equipment required in 29 CFR 1926.
2. Adequate personal protective equipment shall be provided and maintained on the job at each specified work location for use by up to three qualified Authority employees and each inspector from the Authority assigned to the project. This equipment shall be suitable to allow the Authority's personnel access to any area in which work is being performed.

3.06 COATINGS ON CLEANED METAL SURFACES

A. General

1. The coatings shall be applied only when weather conditions and steel surface conditions comply with the coating manufacturer's recommendations or as modified herein. The Contractor shall take whatever steps are necessary to maintain controlled environment in order to ensure that pre-application, application and post-application conditions are in accordance with these documents and the coating manufacturer's recommendations.
2. Coatings shall be applied at the recommended spreading rates, but thicknesses shall not be less than the minimum dry film thickness specified. Should the spreading rate fail to produce full coverage of the required thickness in one coat, additional coating shall be applied until the minimum requirements are met.
3. Coatings shall be applied in strict compliance with the manufacturer's recommendations or as modified herein, including storage, mixing, handling, environmental conditions, surface temperature and additives for accelerated drying if necessary. All coating materials shall be delivered to the applicator in

- the manufacturer's original containers, unopened and with the label bearing the manufacturer's name, product identification and application instructions.
4. No coating work shall be conducted when the steel substrate surface temperature is less than five (5) degrees F above the dew point; or below or above the manufacturer's recommended steel surface temperature; or the relative humidity is over 85%.
 5. Ties are to remain in place. Apply coating to 100% of the top surfaces of track stringers and bracing between the ties, and to 100% of the surfaces of the cross girders.
 6. Contractor shall contain paint over-spray during paint spray operations. Contractor shall not build-up paint in vicinity of wood ties or power distribution cables.
- B. In preparation of previously painted surfaces when it is approved by the Authority not to remove all existing paint or the existing coatings are determined to not contain lead; it is necessary to remove all corrosion and all paint which shows evidence of corrosion, peeling, excessive thickness, brittleness, blistering, scaling or general disintegration. It is essential that the removal of the old paint be carried back around the edges of the spot or area until an area of completely intact and adhering paint film, with no rust or blisters underneath, is attained. Edges of tightly adherent paint remaining around the area to be recoated shall be feathered so that the repainted surface can have a smooth appearance. The remaining old paint should have sufficient adhesion so that it cannot be lifted as a layer either by inserting a blade of a dull putty knife under it or cracked off by impact of a hand chipping hammer. Priming, protective coating, and top coating are required for surfaces where the old paint and primer has been fully removed. For surfaces where the old primer is in sound adhesion to the substrate, protective coating and a top coating are only required.
- C. Inspection: All surfaces to be coated shall be thoroughly cleaned to the satisfaction of the Authority and shall be inspected in accordance with the inspection requirements outlined in the Contractor's Quality Program as specified in guidelines for contractor's quality program of this contract and accepted by the Authority before any coating is applied.
- D. Epoxy-Mastic Protective Coat
1. Deeply pitted areas shall receive one (1) brush-applied spot coat of protective coating material, 5 mils dry film thickness.
 2. All cleaned areas of the entire metal structure, plus three (3) inches of adjacent concrete surfaces and the deeply pitted spot-prime areas, shall receive one (1) coat of protective primer material between seven (7) mils minimum and eleven (11) mils maximum dry film thickness, above the metal substrate.

E. Top Coat

1. The entire structure shall receive a minimum of one (1) spray coat or two (2) rolled coats of Aliphatic Acrylic Urethane top coat material, between two (2) mils minimum and five (5) mils maximum dry film thickness. When applying recoats, all additional coats are to be within manufacturer's recoat window.
2. Top coating should be applied as soon as recommended by the manufacturer, as specified in the Contract Documents, and/or as approved by the Authority.
3. All material shall be applied within recoat windows per manufacturer's requirements.

F. Clean-Up

1. Oily or paint-filled rags or waste and other combustible materials shall be the responsibility of the Contractor. The Contractor shall dispose of these materials in metal containers with tight fitting lids on a daily basis. The proper disposal of these materials is the responsibility of the Contractor.
2. Prior to final completion and acceptance, the Contractor shall examine all painted and finished surfaces and retouch or refinish as necessary to leave all surfaces in acceptable condition to the Authority.
3. Upon completion of the work, the Contractor shall remove all paint and varnish spots from floors, glass and other surfaces and remove all rubbish and other accumulated materials of this nature from the premises and dispose of same legally. Work areas shall be left in a clean and orderly condition acceptable to the Authority.
4. The areas where surface preparation work is being performed shall be cleaned of all residue and be in broom clean condition upon completion of each day's work.

END OF SECTION 09 90 10

SECTION 10 20 00
LOUVERS AND VENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes the following:
1. Fixed decorative stainless steel wall louvers.

1.03 RELATED WORK

- A. Section 07 90 00, Joint Sealers

1.04 REFERENCES

- A. AMCA Standard 500 - Test Method for Louvers, Dampers and Shutters; Air Movement and Control Association, Inc.
- B. SPC-Paint 12 - Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).

1.05 DEFINITIONS

- A. Louver Terminology: Refer to AMCA Publication 501-85 for definitions of terms for metal louvers not otherwise defined in this section or referenced standards.

1.06 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fasteners and anchors:
1. Wind Load: Uniform pressure (velocity pressure) of 25 lb per sq. ft. acting inwards or outwards.
 2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss. Temperature change (range); 100 degrees Fahrenheit.
- B. Air Performance, Water Penetration, and Air Leakage Ratings: Provide storm-resistant louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500.

1.07 SUBMITTALS

- A. Product data for each product indicated.
- B. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; and profiles of frames at jambs, heads and sills. Where installed products are indicated to comply with certain structural design loadings, include structural computations, material properties, and other information needed for structural analysis which has been prepared by, or under the supervision of, a qualified professional engineer. Include location and size of blank-off panels.
- C. Samples for verification purposes of each type of metal finish required, prepared on 6 inch square metal samples of same thickness and alloy indicated for final unit of Work.
- D. Product test reports evidencing compliance of units with performance requirements indicated.
- E. Product certificates signed by louver manufacturers certifying that their products which comply with Project requirements are licensed to bear AMCA Seal based on tests made in accordance with AMCA Standard 500 and complying with AMCA Certified Ratings Program.
- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience.

1.08 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain louvers and vents from a single source.
- B. Qualify welding processes and welding operators in accordance with D1.3 "Structural Welding Code - Sheet Steel."
 - 1. Certify that each welder employed in unit of Work of this section has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 - 2. Testing for recertification is Contractor's responsibility.
- C. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated which has resulted in the successful installation of louvers similar in material, design, and extent to that indicated for this Project.
- D. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" specifications for fabrication, construction details, and installation procedures.

1.09 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fasteners and anchors:
 - 1. Wind Load: Uniform pressure (velocity pressure) of 25 lb per sq. ft. acting inwards or outwards.
 - 2. Normal thermal movement is defined as that resulting from the following

maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss. Temperature change (range); 100 degrees Fahrenheit.

- B. Air Performance, Water Penetration, and Air Leakage Ratings: Provide storm-resistant louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500.

1.10 PROJECT CONDITIONS

- A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication of louvers and vents without field measurements. Coordinate wall construction to ensure actual opening dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Louvers and Vents:
 - 1. Airline Products Co.
 - 2. Airolite Co.
 - 3. American Warming and Ventilating, Inc.
 - 4. Arrow United Industries.
 - 5. Construction Specialties, Inc.
 - 6. Dowco Products Group; Safe-Air of Illinois, Inc.
 - 7. Greenheck.
 - 8. Industrial Louvers, Inc.
 - 9. Penn Ventilator Co., Inc.
 - 10. Reliable Metal Products.
 - 11. Ruskin Mfg. Div., Phillips Industries, Inc.

2.02 MATERIALS

- A. Stainless-Steel Sheet: ASTM A666, Type 304, with No. 4 finish.
- B. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types, gauges, and lengths to suit unit installation conditions.
 - 2. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
 - 3. Finish of fastener heads exposed to view to match adjacent surface.
- C. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- D. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

2.03 FABRICATION, GENERAL

- A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance. Coordinate shop drawings, field measurements, and shop fabrication.
- B. Preassemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of size indicated with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.
Fabricate frames to indicated profiles with features and clearances to suit installation conditions. Provide clearance or recesses as required to accommodate sealant between louver and adjacent construction.
 - 1. Frame Type: Channel.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated but not further apart than specified by manufacturer, or 72 inches on center, whichever is less. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated.
- G. Provide sill extensions and loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.
- H. Unless otherwise indicated, or size of louver assembly makes bolted connections between frame members necessary, join frame members to one another and to fixed louver blades with fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.04 FIXED METAL WALL LOUVERS

- A. Horizontal Dual Drain Fixed Blade Louvers: Metal louver blades with supporting metal framework.
- B. Fabricate blades and frame from sheet metal, minimum thickness of 0.062 inch for frames and 0.052 inch for blades.
- C. Minimum free area to be 50 percent; design air velocity to be 500 feet per minute; no water penetration below design velocity; maximum static pressure drop at design velocity to be 0.18 inch water. Accessories: blank-off panels, insect screens, subsill flashing.

2.05 LOUVER CONSTRUCTION

- A. Stainless Steel Louvers: Fabricate blades and frame from stainless steel sheet, minimum thickness of 0.062 with grain running parallel to length of blades and frame members with No. 4 finish.

2.06 LOUVER SCREENS

- A. General: Provide each exterior louver with removable louver screens complying with the following requirements:
 - 1. Screen Location for Exterior Fixed Louvers: Interior face, unless otherwise indicated.
 - 2. Screening Type: Insect screening where indicated.
- B. Secure screens to louver frames with stainless steel machine screws, spaced at 3 inches from each corner and at 12 inch o.c. between.
- C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:
 - 1. Metal: Same kind and form of metal as indicated for louver frames to which screens are attached. Reinforce extruded aluminum screen frames at corners with clips.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Rewireable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Stainless Steel Louvers:
- E. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

2.07 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for specifications relative to application and designations of finishes.
- B. Finish louvers after assembly.

2.08 STAINLESS STEEL SHEET FINISHES

- A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Verify that substrates and openings to receive louvers are rigidly set, at proper lines and elevation, properly sized, and ready to receive louvers.
- C. Do not proceed with installation until conditions detrimental to proper installation have been corrected.

3.02 INSTALLATION

- A. Install louvers in accordance with manufacturer's instructions and shop drawings.
- B. Locate and place louver and vent units plumb, level, and in proper alignment with adjacent work. Ensure watertight installation.
- C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- D. Form closely fitted joints with exposed connections accurately located and secured.
- E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- F. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units.
- G. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals.
- H. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses where required to make louver joints weathertight. Comply with Section 07900, Joint Sealers for sealants applied during installation of louver.

3.03 ADJUSTING AND PROTECTION

- A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Engineer, remove damaged units and replace with new units. Clean and touch-up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.04 CLEANING

- A. Periodically clean exposed surfaces of louvers and vents, which are not protected by

temporary covering, to remove fingerprints and soil during construction period; do not let soil accumulate until final cleaning.

- B. Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

END OF SECTION 10 20 00

SECTION 10 41 60
TRANSIT INFORMATION CABINETS AND PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification covers the requirements to supply and install free-standing information cabinets - framed or encased or aluminum frames on panels, to display current information such as schedules/schedule changes, maps, and temporary conditions at various rapid transit stations. The design and installation of Transit Information Cabinets and Panels will make the information clearly visible to the public and ease its updating by the Authority.

1.03 REFERENCES

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- C. ASTM D1003 – Standard Test Method for Haze and Luminous Transmittance of Transparent
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- E. FS CCC-W-408 - Wall Covering, Vinyl-Coated

1.04 SPECIFICATIONS

- A. It is not the purpose of this specification to specify all the intricate design characteristics of a free- standing information cabinet or panel. However, this specification does include typical characteristics and requirements that the free-standing information cabinet or panel shall have in order to comply with the Authority's intentions.
- B. Free-standing information cabinet or panels required consist of 2 styles:
1. Cabinet: Either a 2 door or 3 door front access
 2. Frame: 2 or 3 aluminum poster frames mounted on a stainless steel panel.
- C. Cabinets or panels shall be floor-mounted with stainless steel tube supports on each end of the stainless steel board assembly. See drawings or contact the Authority to determine the number of each type of Information Cabinet or panel required for this project.
- D. A sketch of a two/three door or aluminum poster frame free standing cabinet is available from the Authority as reference. The two door style is referred to as a P-18-2 and the three door, a P-18-3. The two/three aluminum poster frames style is referred to as a P-37. The sketch is not intended to be complete with exact dimensions, however, the sketch, is representative of a design that would meet the approval of the Authority.
- E. Shop drawings for fabrication and installation of Transit Information Cabinets or Panels

shall be submitted to the Manager, Signage and Wayfinding for approval prior to manufacture. Drawings shall include plans, elevations, and large-scale details of character layout and also show anchorages and accessories. Location template drawings shall be submitted with shop drawings.

- F. Provide specifications for the materials to be used for the Transit Information Cabinets or Panels.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cabinet fabrication shall be made of 16 gauge stainless steel (minimum). Stainless steel sheets utilized shall meet or exceed the strength and durability properties specified in ASTM B209 (latest version) for 5005-H15 material. All sides shall be clad using the same material with a #4 finish. Front access doors shall use a continuous partially concealed stainless steel piano-hinge on one end of door.
- B. CABINET MODEL
 1. The cabinet shall contain 2 hinged stainless steel door frames. Door frames will house 1/4 inch clear tempered glass, gasketed in a stainless steel frame.
 2. Transparent sheet material provided shall be a clear colorless sheet with light transmittance of 92 percent when tested in accordance with requirements of ASTM D1003.
 3. Locks: All cabinets shall have lock(s) with a cam design that can be opened with a Chicago Lock Company #1289 key. Keys shall be removable in locked or unlocked position.
 4. Tackboard: Provide mildew-resistant, washable, vinyl fabric complying with FS CCC-W-408, Type II, laminated to 1/2 inch thick exterior grade plywood backing. All laminating adhesives and tackboard material shall be designed for exterior usage. Fabric shall have a flame spread rating of 25 or less when tested in accordance with ASTM E84. Provide color and texture as selected from the manufacturers standards.
 5. Brackets: Brackets shall be made of steel material to suit the information board construction and mounting requirements. Brackets may be painted to match the background finish of cabinet.
 6. Fasteners: All fasteners should be of a concealed design for cosmetic appearance and fasteners should be fabricated from a non-corrosive material. Fasteners required to be activated for access or maintenance shall be stainless steel and shall thread into stainless steel inserts in the enclosure. No aluminum fasteners will be permitted.
 7. Legends and Headers: Two porcelain enamel on steel legends; 4 inch H by 48 inch W (use CTA Drill Pattern Detail 'Y') are required and mounted with rivets on the front face of the
Transit Information Cabinet at the top and bottom as shown on Detail 1 Elevation drawing of drawing available from the Authority. Panels shall be white on black and fabricated according to relevant CTA Specification (spec.1694-02 or latest revision). Artwork and wording for these signs shall be provided by the Authority in electronic format.
 8. Both the two and three door assemblies use 2 rectangular stainless steel 2 inch by 6 inch by 1/4 inch tube supports with 1/2 inch thick welded stainless steel base plates at the bottom of the tubes for the anchor attachment to the floor that will use 4 bolts per side.
 9. Stainless steel cladding shall be welded to internal stainless steel frame. Frame shall have a minimum of 2 inch by 2 inch by 1/8 inch tubing continuously welded

at joints.

10. Information cabinets shall have vertical stainless steel 3/4 inch reveals, which will be visible from front and back, running full height of cabinet at both ends between cabinet and tube supports legs.

C. POSTER FRAME MODEL

1. Frames on stainless steel panel. Use Alpina™ branded FF-RP aluminum frame. Satin finish. Finished size: 28.75" x 41.75". Verify with CTA Signage before ordering.
2. Fasteners: All fasteners should be of a concealed design for cosmetic appearance and fasteners should be fabricated from a non-corrosive material. Fasteners required to be activated for access or maintenance shall be stainless steel and shall thread into stainless steel inserts in the enclosure. No aluminum fasteners will be permitted. Attach fasteners to inside cavity of the aluminum frame.
3. Legends and Headers: Use supplied artwork from the Chicago Transit Authority to produce die-cut vinyl appliqué for the header and legend fields of the transit panel. Helvetica Bold is the preferred font. The vinyl material used for header and footer shall be a permanent set, electronically cuttable, high performance, opaque gloss black vinyl film, for use on stainless steel, such as Avery 1003, 3M Scotchcal 220 or equal. Follow drawings for installation location on panel.
4. The aluminum poster frame model uses 2 rectangular stainless steel 2 inch by 6 inch by 1/4 inch tube supports with 1/2 inch thick welded stainless steel base plates at the bottom of the tubes for the anchor attachment to the floor that will use 4 bolts per side.
5. Stainless steel cladding shall be welded to internal stainless steel frame. Frame shall have a minimum of 2 inch by 2 inch by 1/8 inch tubing continuously welded at joints.
6. Information panels shall have vertical stainless steel 3/4 inch reveals, which will be visible from front and back, running full height of panel at both ends between panel and tube supports legs.

2.02 FABRICATION

A. CABINET MODEL

1. Two door assembly: Upper cabinet section shall be 4 foot-9 inch high by 6 foot-1 inch length by 6 inch width (depth) with 2 hinged doors supported by 2 rectangular tube supports mounted to the floor for an overall height of 7 foot-0 inch from top to finished floor.
2. The three door is similar to the two door, except larger with 3 hinged doors supported by 2 rectangular tube supports mounted to the floor for an overall height of 7 foot-0 inch from top to finished floor. The three door upper cabinet dimensions are: 4 foot-9 inch high by 8 foot-9 inch length by 6 inch width (depth).
3. Protection of metals against galvanic action shall be provided wherever dissimilar metals are in contact. All metals, except galvanized steel which will be in contact with concrete, mortar, plaster, or other masonry, shall be protected. Protection shall consist of painting the contact surfaces with a heavy brush coat of bituminous paint.
4. Cabinet shall be delivered completely assembled. If the assembly cannot be delivered complete, the Contractor shall shop-assemble the complete assembly, mark, and disassemble before shipping to insure proper assembly in the field. Field joints in Transit Information Cabinet faces shall not be allowed.
5. Welding of assembly shall be done in accordance with appropriate specifications of American Welding Society and shall be done with electrodes and methods

specified by the manufacturers of alloys being welding. Welds behind finished surfaces shall be so done as to minimize distortion and discoloration of finished side. Weld beads on exposed finished surfaces shall be ground and finished to match and blend with finish on adjacent parent metal.

B. ALUMINUM POSTER FRAME MODEL

1. 96" length unit can hold up to three aluminum frames. Upper panel section shall be 4 foot high by 8 foot length by 4 inch width (depth) supported by 2 rectangular tube supports mounted to the floor for an overall height of 7 foot-0 inch from top to finished floor.
2. 66" length unit can hold up to two aluminum frames. Upper panel section shall be 4 foot high by 5 foot 6 inch length by 4 inch width (depth) supported by 2 rectangular tube supports mounted to the floor for an overall height of 7 foot-0 inch from top to finished floor.
3. Protection of metals against galvanic action shall be provided wherever dissimilar metals are in contact. All metals, except galvanized steel which will be in contact with concrete, mortar, plaster, or other masonry, shall be protected. Protection shall consist of painting the contact surfaces with a heavy brush coat of bituminous paint.
4. Panel shall be delivered completely assembled. If the assembly cannot be delivered complete, the Contractor shall shop-assemble the complete assembly, mark, and disassemble before shipping to insure proper assembly in the field. Field joints in Transit Information Panel faces shall not be allowed.
5. Welding of assembly shall be done in accordance with appropriate specifications of American Welding Society and shall be done with electrodes and methods specified by the manufacturers of alloys being welding. Welds behind finished surfaces shall be so done as to minimize distortion and discoloration of finished side. Weld beads on exposed finished surfaces shall be ground and finished to match and blend with finish on adjacent parent metal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install Transit information cabinet or panel units level, plumb and at the height indicated with the Transit information cabinet or panel surfaces free from distortion or other defects in appearance.
- B. Floor mounted information cabinet must conform to the Americans with Disabilities Act (ADA) which requires that the Transit information cabinet have a floor clearance of 27 inches. This will allow visually impaired customers to use a cane to identify the board before colliding with it and wheelchair users knee space for viewing graphic material posted inside.
- C. Furnish inserts as required when setting into concrete of masonry work or installing into existing concrete. Use non-ferrous metal or hot dipped galvanized anchors and inserts. Use toothed steel or lead expansion bolt devices for drilled in place anchors.
- D. Delivery: Transit Information Cabinet or panel shall be adequately protected during delivery to prevent damage from scratching, stains, discoloration or other causes. Damage to any surface during fabrication, handling, shipment, storage, and installation shall be remedied by the Contractor at the Contractor's own expense.
- E. Cleaning: Upon completion of the installation, clean soiled Transit Information Cabinet or panel surfaces in accordance with the manufacturer's instructions.

3.02 ADDITIONAL INFORMATION FOR SIGN REQUIREMENTS

- A. Sign shall be constructed using porcelain enamel on 16 gauge steel, in compliance with all applicable technical specifications.
- B. Signs shall be used outdoors and shall be expected to withstand all weather conditions for their installed location for a minimum of 10 years with minimal fading.
- C. The films listed herein were approved by the Authority for their ability to withstand numerous mechanical scrubblings with harsh alkali detergents in the Authority's rail car and bus wash racks without delaminating, peeling off or showing appreciable fading, chalking, blistering, cracking or tearing for a minimum of seven (7) years. Substitute film(s) shall be designed to be equal in performance and submitted to the Authority for its review and approval.
- D. Approved manufacturer of the Aluminum Poster Frame for the Authority: Alpina Manufacturing, 3418 North Knox Avenue, Chicago, IL 60641; 1-800-915-2828, 1-800-217-9431 (fax).
- E. Frame: Graphic Size 27" x 40" silver wide round profile flip-up frame, IT=Poster, .020" clear overlay, .040" backer, assembled with drain holes.

END OF SECTION 10 41 60

SECTION 10 42 50
VITREOUS ENAMELED STEEL SIGNS

PART 1 GENERAL

1.01 SUMMARY

- A. This specification covers the requirements for furnishing and installing vitreous enameled steel (porcelain) signs for the Chicago Transit Authority.
- B. This specification is intended to be descriptive, not restrictive, and is solely for the purpose of indicating the type and quality of vitreous enamel signs which would meet the approval of the Authority.

1.02 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 05 Section, "Metal Fabrications".

1.03 REFERENCE STANDARDS

- A. The Work is subject to applicable portions of the following standards:
 - 1. "Specification for Architectural Porcelain Enamel on Steel for Exterior Use", PEI S-10, Porcelain Enamel Institute (PEI).
 - 2. ASTM A424

1.04 SUBMITTALS

- A. Contractor is required to submit a sample finished sign no later than thirty (30) days after Contract award. The sample will be fabricated using artwork supplied by the Authority's Signage and Wayfinding Department. Artwork will be furnished in Adobe® Illustrator® electronic format.
- B. Sample metal blank shall follow Detail "C" of CTA Drawing OP-8442, except as noted herein. The steel blank shall measure 12 inches x 18 inches as indicated in the drawing, however the four (4) holes shall be 3/8 inch diameter rather than 5/16 inch diameter. Only two (2) of the four (4) holes in the finished sample shall have stainless steel grommets designed for 1/4" diameter fasteners installed. Sample shall be produced in PMS 200 blue, white, and black.
- C. Finished sample sign must be submitted for review with respect to size, color and compliance to this specification. Sample must be approved by Manager, Signage and Wayfinding, before any contract is awarded. Failure to submit a sample within the time limit specified will be sufficient cause for rejection.
- D. Upon approval of sample sign, Contractor will receive individual artwork to be used to fabricate signs being produced for this project. The artwork will be furnished in Adobe® Illustrator® electronic format.
- E. Contractor shall verify accurate receipt of each digital artwork received by returning a paper proof copy of each to Manager, Signage and Wayfinding, located at 567 W. Lake St., Chicago, IL 60661, Telephone 312-681-3660, before any production runs are made.

- F. Upon approval of paper proof, Contractor shall produce and submit a sample of the finished production sign for inspection with respect to size, color, and compliance to this specification; prior to full production of the signs.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Signs required shall be listed in the Sign Schedule and the Contract Documents with a description, drawing number(s) and, where available, item number(s).
- B. All mounting holes, unless otherwise specified, in the finished enameled signs shall be 5/16 inch plus or minus 1/64" diameter and fitted with brass eyelet grommets equal to Stimpson Company part number A63B or approved equal to prevent cracking of the enamel during the mounting application.
- C. Enameled holes shall be round and free of irregularities and defects that can affect the eyelet installation, cause crazing or chipping of the enamel during or after eyelet installation, or create irreparable misalignment of the eyelet centers within plus or minus 1/16" of the center- to-center distances dimensions specified on the drawing.
- D. The base metal for all signs shall be #16 gauge porcelain enameling grade steel conforming to ASTM A 424. The Type shall be determined by the Contractor.
- E. Finished signs that are less than 6 inches in length, when resting on the back surface shall be flat within a tolerance of plus or minus 1/32 inch measured diagonally. Finished signs shall be free of sharp edges, burrs, or any other defect that can prove hazardous to personnel or detrimental to the mounting process.
- F. All signs shall have full color coverage with no defects on all surfaces and edges such as discoloration, bubbles, pin holes, chipping or surface crazing.
- G. All signs will be used outdoors and shall be expected to withstand all weather conditions for the city of Chicago and surrounding suburbs, for a minimum of ten (10) years with minimal fading, cracking and surface crazing.
- H. Colors indicated in the descriptions shall be equal to Pantone numbers (747XR Standard). Typical CTA color examples with cross references are as follows:

<u>Color</u>	<u>Pantone #</u>
Safety Red	200
Red	186
Orange	172
Yellow	012
Green	355
Olympic Blue	299
Accessible Blue	300 C
Historic Blue	282C
Pace Bus Blue	Reflex Blue C
Purple	267
Brown	161
Neutral Gray	425C
Pink Line Pink	204 C
Black	Process Black C
White	

- I. Prior to the application of the porcelain enamel coating, the base metal shall be treated with a suitable metal treatment designed to produce maximum adherence of the porcelain enamel coating. Holes shall be punched or drilled and all holes and edges to be dressed to remove burrs, sharp edges and all irregularities prior to treatment.
- J. The vitreous porcelain enamel sign coatings shall consist of one ground coat and one or more cover coats fired at a temperature from 1400 degrees F to 1600 degrees F. Unless otherwise specified the final coat shall be a glossy finish.
- K. Following the firing of the background color, additional porcelain enamel colors are to be applied by the silk screen process, or other method approved by the CTA, to accomplish the desired graphic design.
- L. Art work for requested signs shall be provided by the CTA in electronic format.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to installation, all signs shall be inspected by the CTA. All signs must meet the quality parameters of the approved sample. The purpose of this inspection is to verify quality of manufacture and conformance to requirements for the fabrication, color, artwork, etc. of each type of sign. Inspection will be conducted at the Contractor's premises, or at any other mutually agreeable location. The Contractor shall provide the Authority with a minimum of seven working days' notice prior to inspection.
- B. Installer of signs shall verify all locations, sizes, installation and mounting conditions, type of anchorage required and working conditions in the field.
- C. A representative from the Authority may review the existing conditions with the installer prior to installation. The purpose of this inspection is to verify actual locations, method and quality of installation, dimensions, heights, space limitations, and other installation conditions for each sign. The scheduling of this inspection shall be mutually agreed upon by all parties.
- D. Contractor to verify the existence of any utilities cables or other existing items or construction that may be in the way of the new signs and this installation. Relocate sign as approved to avoid relocation of utilities or interference with the sign as approved by the Authority.
- E. After installation, a final inspection in the field will be conducted by the Authority. The purpose of this inspection is to verify quality of installation, correct location of signs, etc. The Contractor shall provide the CTA with a minimum of seven working days' notice prior to inspection.

3.02 REMOVAL OF EXISTING SIGNS

- A. Removal of existing signs
 - 1. If applicable or as otherwise directed, the Contractor shall remove all existing signs of the type that is being replaced or that are nonconforming. All existing signs shall be turned over to the Authority and delivered to a specific location as directed. Also remove all existing accessories not needed for the new signs. Remove all existing signs and accessories with care so as not to damage the signs or existing surfaces.
 - 2. Existing signs to be removed may be pop riveted, bolted, or welded to its substrate. Unless noted to be re-used, existing backer plates, framing, straps, anchors, support posts, etc. used with the existing signs shall be removed. Other items may have to be removed, relocated, or altered to allow for the installation of the new signs.
- B. Clean surfaces where existing signs have been removed and clean surfaces that are to receive new signs. Remove any projections or obstructions. Do not reuse existing anchorage devices and other accessories.
- C. For any surface where existing signs and their accessories have been removed and the new signs will not cover, touch up the finish and/or paint to match the existing adjacent surfaces.
- D. Contractor shall identify any existing historic landmark or monument type signs. These signs shall not be removed unless approved otherwise in writing by the Authority.

3.03 INSTALLATION

- A. General: Install signs according to Contract documents or to match existing locations, heights, and mounting details unless indicated or directed otherwise. Variations may be directed by or approved by the Authority's field representative during the pre-installation walk-thru or during the actual installation based on actual field conditions and interference. Use approved mounting methods, mounting accessories, and attachment devices. No glue installations are permitted.
- B. Installation and anchorage shall be solid and secure. Provide and install all indicated backer plates, frames, support, posts, and other mounting accessories. Provide and install any additional steel framing or other support or accessories required. Where indicated or required, modify existing frame to accept new sign assembly.
- C. Install signs and all mounting accessories level, plumb, and flush with substrates. Sign surfaces shall be free from distortion or other defects in appearance. Mounting heights shall be as shown on drawings, as required and consistent throughout project unless indicated otherwise or required to avoid interference and approval by the Authority.
- D. Provide and install all required attachment devices, brackets, pendants and hardware. Fasteners and other accessories shall be as specified for the application. All fasteners and accessories shall be stainless steel unless noted otherwise. Use expansion anchors, self-tapping screws, pop-rivets, bolts and nuts, etc. as required. Drill as required. Use countersunk screws where exposed or necessary. Exposed fasteners shall be tamper resistant. Weld where indicated with full, tack, or stitch welds. Glue installations of any kind are not permitted, including as a means to attach the sign to backer plate.
- E. Installation of backer plate:

1. Directly to Substrate: Attach backer plate directly to wall, column, light pole, railing, windbreak, etc. by welding or using countersunk screws. Hole locations may be new, existing, or existing to be tapped. Use metal spacers behind the backer plate at each screw location where there are obstructions or minor projections at the surface where indicated on the drawings. Use countersunk expansion anchors when securing backer plate to masonry or concrete.
2. To Metal Frames, Horizontal Supports, Vertical Support Posts or railings: Attach backer plate to a frame made up of metal channels or tubes by welding or using countersunk screws. Attach backer plate to metal channel or tube supports, posts, angles, straps, or hangers by welding or using countersunk screws.

F. Installation of Metal Frames or Supports:

1. Weld or bolt metal frames, supports, or support posts to beam, columns, light poles, railing, or windbreak as directed. Use expansion anchors for securing frames, supports, or hangers to masonry or concrete. Drill and grout or imbed supports in new concrete where indicated.

G. Installation of Plastic and Frame:

1. Unless indicated otherwise, secure plastic frame to built-up welded metal channel frame with stainless steel pop rivets. Provide holes in frame to accept plastic sign frame. Where indicated, install plastic sign frame directly to steel fascia or steel ad frame. Install sign in plastic frame.

H. Installation of Signs:

1. Directly to Substrate: Determine that surface is clean and smooth. Secure signs to substrate using stainless steel pop-rivets. See drawings for spacings.
2. To Surface: Surface mounted signs include installations on any flat surface which can be, but are not limited to, walls, canopy support and platform columns, sign frames, sign supports, and stair risers. Fastening hardware shall be 1/4-20 tamper-resistant machine screw (TORX T27 with Security Pin 1/4-20, T27) with 1/4-20 self-locking hex head nut (nylon insert) or blind aluminum or stainless steel rivet, as determined by the Authority.
3. To Metal Frame: Welded metal tube or channel frame with mitered corners shall be slightly larger than sign. Secure sign to frame with pop rivets using approved spacings.
4. To Backer Plate: Metal surface of backer plate shall be clean and smooth with all countersunk screws properly installed. Backer plates shall be same exact size as sign. Secure sign to backer plate using stainless steel pop-rivets or tamper-resistant machine screws as indicated (drill/tap backer plate to accept screws) using approved spacings.
5. Pendant Bracket Mounted Sign: Pendant mountings are generally described as those which require two sign faces, back to back, attached to and supported by metal brackets (or similar metal supports), sandwiched between the two sign faces. Brackets shall be configured to provide proper mounting of sign. Fastening hardware and type of installation shall be equivalent to that which is existing.
6. Bracket-Mounted Units: Provide the manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.
7. Panel Mounted Non-Illuminated signs: Panel mounted signs include installations on any flat or curved surface which can be, but are not limited to, acoustical panels, etc. Fastening hardware shall be 1/4-20 taper resistant machine screws

(TORX T27 with Security Pin 1/4-20, T27) with 1/4-20 self-locking head nut (nylon insert) attached to panel. Glue installations are not permitted.

8. Trim signs as required to fit locations only with approval of Authority. Modify existing sign frames, backer plates, supports, etc. as required for new signs.

3.04 FIELD PAINTING

- A. The pre-finished backer plates shall have their finish touched up as required where exposed to view after installation of the signs.
- B. Galvanized metals cut or drilled in the field shall have its galvanized finish touched up in the field with approved galvanizing repair paint.
- C. Dissimilar metals: To avoid galvanic action, separate dissimilar metals with approved paint.
- D. Any mounting accessories such as angles, channels, plates, bent plates, clip angles, tubes, posts, etc. that will be exposed to view after installation of the sign, shall be field painted to match the backer plates. New wood posts and other members shall also be primed and finished to match the backer plates.
- E. Care shall be taken to not get paint on the new signs or any other existing surface.

3.05 CLEANING AND PROTECTION

- A. Signs shall be adequately protected during their delivery and installation to prevent damage by scratches, marring, stains, discoloration, or other causes. The sign faces shall be protected with a protective covering. The signs shall be crated. Damage to any surface during fabrication, handling, shipment, storage, and installation shall be remedied by the Contractor at Contractor's own expense. Replace any damaged signs that cannot be cleaned or repaired.
- B. Before delivery to the site, each sign shall be tagged or labeled with the identifying number and installation location as shown in the specifications. Labeling shall be on both the sign and the protective covering.
- C. At completion of the installation, remove the protective coating and clean soiled sign surfaces, and surfaces against which the new sign has been mounted, in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Authority.

END OF SECTION 10 42 50

SECTION 10 42 60
ILLUMINATED SIGNS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.
- B. Scope
 - 1. This section includes the following types of signs:
 - a. Illuminated informational signs.
 - b. Illuminated Chicago Transit Authority Station Identifier signs.
 - 2. General: Provide and install signs, mounting accessories, attachment devices, and associated hardware for installation in accordance with requirements of the contract documents. These signs are used at various locations at the transit stations. The number of signs, size of each sign, type of sign, graphics, location for each sign, and type of installation for the signs are indicated on the drawings and/or schedules. The Authority will supply original artwork for the sign faces in Adobe Illustrator electronic format. Remove existing signs as specified herein. Provide additional framing and supports as indicated on the drawings or required. Provide mounting accessories, attachment devices and associated hardware as specified, as shown on the drawings, or as otherwise required.
 - 3. Verify sign locations and installation conditions in the field.
 - 4. See drawings, schedules, and/or verify in the field for standard and special installation details for each sign; type of installation, anchorage, mounting heights, mounting conditions, additional framing and support required, installation accessories required, spacing of anchors, and other details.
- C. Related work specified elsewhere:
 - 1. Division 5 – Metal Fabrications.
 - 2. Division 10 – Vitreous Enameled Steel Signs.
 - 3. Division 16 - Electrical.
- D. Reference Standards: The work is subject to applicable portions of the following standards:
 - 1. "Electric Signs", Standards for Safety, UL Publication 48, Underwriters Laboratories Inc.

1.02 SUBMITTALS

- A. Product Data: Include manufacturer's technical data, complete technical specifications and construction details relative to materials, dimensions of individual components, profiles, finishes, and installation details for each type of sign required. Indicate proposed materials and fabrication of signs.
- B. Shop Drawings: Submit shop Drawings to the Authority for review and approval prior to fabrication of illuminated signs. Provide shop drawings for fabrication of each type of sign. Provide shop drawings for each installation condition for each type of sign. Include typical details of materials, fabrication, and graphics. Include plans, elevations, and large-scale sections of sign face, sign frame or housing, typical members and other

components. Show anchors, reinforcement, accessories, layout, and installation details.

1. Provide complete sign schedule for illuminated signs, including the following information for each sign:
 - a. CTA sign identifier.
 - b. Quantity.
 - c. Mounting type.
 - d. Dimensions
 - e. Visual opening
 - f. Blank size
 - g. Colors
 - h. Message
 - i. Cross references to the following detail drawings:
 - 1) Graphic Detail
 - 2) Elevation Detail
 - 3) Section Detail
 - 4) Mounting Detail
 - j. CTA Design Number
 - k. Remarks
 - l. Mounting Height
 - m. Signage Plan Drawing Reference
 2. Provide drawings for graphics for each sign, including dimensions of sign face, sign blank, visual opening, sign message and sign colors.
 3. Provide separate elevation details, section details, and mounting details for each sign.
 4. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed.
- C. Provide wiring diagrams from the manufacturer for each type of illuminated sign units. Provide specifications for each type of lamp, ballast and other electrical components used.
- D. Samples: Submit samples of each sign material or component used showing finishes, colors, surface textures and qualities of manufacturer.
1. Submit full-size sample units, if requested by the Authority. Acceptable units may be installed as part of work.
 2. Color samples, 3 each of all paint colors, on specified materials for illuminated signs and station identifier sign. Color samples will be retained by the Authority.
 3. Sign face: Provide a sample panel of each sign type, not less than 8-1/2 inches by 11 inches. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.
 4. As required by the Authority, provide full size samples for approval of any accessories proposed for the installation and attachment of the signs, including hangers, straps, frames and other attachment accessories.
- E. Submit a material list of all mounting accessories including reinforcing, angles, channels, hangers, straps, frames, etc. Indicate all materials, sizes, thicknesses, shapes, etc.
- F. Submit a material list of all attachment devices including anchors, screws, washers,

gommets, and rivets indicating material, size, and spacings. Indicate weld types, sizes and locations.

- G. Approval of the shop drawings by the Authority is required prior to issuance of digital artwork file.

1.03 QUALITY ASSURANCE

- A. Submit adequate evidence, prior to awarding of the contract, that the items to be furnished will conform completely to the contract documents.
- B. Fabricator and Installer: Experienced specialty firms having a minimum of 5 years successful experience and regularly engaged in fabricating and installing work of same types required for this project. Employ only skilled tradesmen who are thoroughly experienced with the materials and equipment to be used in the work.
- C. Sign/Support Performance: Provide outdoor sign assemblies designed, tested, and installed to withstand positive and negative wind loading of 40 psf (1.9 kPa) wind pressure loading, in accordance with Chicago Building Code. Signs to be moisture proof.
- D. UL and NEMA Compliance: Provide lighting fixtures and electrical components for illuminated signs that are labeled and listed by UL and comply with applicable NEMA standards.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Signs shall be adequately protected during delivery of the work to prevent damage by scratches, stains, discoloration, or other causes. The signs shall be crated. Damage to any surface during fabrication, handling, shipment, storage, and installation shall be remedied by the Contractor at Contractor's own expense.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings.
- B. Field Conditions: For each station, verify in the field prior to installation the number, location, heights, and installation conditions for each type of sign. Discrepancies shall be reported to the designated representative from the Authority for review and determination. Similarly, report any conflicts to the proper installation of the sign at the location designated. Adjustments in the field will have to be made according to actual field conditions. CTA field representative may also dictate adjustments based on actual field conditions at the time of installation.
- C. Contractor to coordinate fabrication and delivery schedule of signs with installation schedule of signs, to avoid delays. Contractor to also coordinate supply of mounting and installation accessories and attachment devices required for installing the signs at each location, according to the installation schedule.
- D. The Authority will provide art work for signs in Adobe Illustrator electronic format.

1.06 WARRANTY

- A. Submit a written warranty for the work of this section. All work, including installation, shall be in exact accordance with these specifications and is to be guaranteed for the minimum period of two years from date of acceptance by Authority, unless noted otherwise.

- B. Finishes Warranty: Submit 5-year written warranty, signed by the Fabricator, Contractor and Installer, warranting that the signage finishes will not develop excessive fading or excessivenon-uniformity of color or shade, and will not chip, crack, peel, pit, or be subject to pin holes, scratching, or otherwise fail as a result of defective materials or workmanship. Upon notification of such details, within the warranty period, make necessary repairs or replacement at the convenience of the Authority and at no cost to the Authority. Warranty shall cover the finishes of all components of the sign assembly: sign face, sign box, sign frame, and all accessories.
1. "Excessive Fading": A change in appearance which is perceptible and objectionable as determined by the Authority when visually compared with the original color range standards.
 2. "Excessive Non-Uniformity": Non-uniform fading during the period of the guarantee to the extent that adjacent panels have a color difference greater than the original acceptable range of color.
 3. "Will Not Pit or Otherwise Corrode": No pitting or other type of corrosion, discernible from a distance of 10' (3 m), resulting from the natural elements in the atmosphere at the project sites.
- C. Cellulose Acetate Butyrate letters and logo warranty: Manufacturer of Cellulose Acetate Butyrate material shall additionally warrant their product to not fade or break for the life of the installation.
- D. Inductively Coupled Electrodeless lamp and ballast system for Station Identifier Signs shall also be warrantied by the manufacturer for five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
1. Acceptable Manufacturers of Illuminated Informational Signs:
 - a. Western Remac, Woodridge, Illinois.
 - b. Doyle Signs, Inc.; Addison, Illinois.
 - c. Pannier Graphics; Gibsonia, Pa.
 - d. or approved equal.

2.02 MATERIALS

- A. Informational Sign boxes: Enclosure to be stainless steel, 20 ga. Number 4 finish.
- B. Station Identifier Sign: Enclosure to be ¼" thick aluminum plate. Flanged leg to be 1/8" thick aluminum angle. Universal mounting bracket from cast aluminum. Solid plate for one sided installations to be ¼" thick aluminum plate. Sign face bottom frame to be 16 ga. Rolled aluminum plate. All aluminum to have a clear anodized finish.
- C. Silk Screens: Photographic screen. Hand cut screens or digital output will not be allowed.
- D. Lamp and ballast system for Station Identifier Signs:
1. Inductively Coupled Electrodeless lamp and ballast system. Lamps (2 per doubled face sign) to be Icetron 100/2P/ECO 100 Watts each, 8000 Initial Lumens, rated for 100,000 hours of life. Ballast QT1X100 ICE/UNV – T, starting

temperature as low as 140 degrees F. 120/277 Volts, 50/60 Hz.

2. Lamp and ballast system as specified to be manufactured by the following:
 - a) Osram Sylvania, Westfield, In.
 - b) Approved Equal.

2.03 MATERIALS – PLASTIC

- A. All plastic shall be UV stabilized. Plastic shall be manufactured of a flame retardant resin that has been tested to comply with U.L. flammability classification 94V-0. Manufacturer to supply certification of conformance plus certification of random flame test sampling during production runs as directed by the Authority.
- B. All plastic shall be manufactured of non-yellowing, clear resins.
- C. Manufacturer of plastic shall certify that all plastic meets or exceeds the following test standards. If requested, the manufacturer shall provide the results of these tests to the Authority:
 1. MIL Spec P7788A surface endurance and scratch resistance, thermal shock, humidity and impact.
 2. OSET Lab, Inc. Emmaqua accelerated weathering for a minimum exposure of one million Langleys without color fade.
 3. Federal Test Method Standard 141, Method 6152; "Accelerated Weathering".
 4. United States Postal Service: Acidity, cleaning compounds and fluids.
 - a. Two plastic sheets shall be immersed in a 0.1 M HCL solution for 30 minutes.
 - b. Two plastic sheets shall be immersed in a 0.1 M MH3 solution for 30 minutes. Plastic shall not be appreciably changed as a result of these tests.

2.04 PLASTIC FOR ILLUMINATED INFORMATIONAL SIGNS

- A. Plastic for the sign faces of Illuminated Informational Signs to be graphic-embedded Fiberglass Reinforced Plastic (FRP), translucent, .180" thick minimum and .250" maximum. Substitutions will not be permitted.
- B. Fiberglass Reinforced Plastic (FRP) shall be non-yellowing, UV stabilized, acrylic-modified polyester resin reinforced with high solubility, chopped strand fiberglass mat so that the index of refraction ensures total clarity of all color, copy and graphics. Glass fibers should not be readily discernable on the sign face and signs shall have a glass content no less than 28% of the total sign weight.
- C. Fiberglass Reinforced Plastic (FRP) shall consist of only flame retardant resin that has been tested to comply with U.L. flammability classification 94V-0. Manufacturer to supply certification of conformance plus certification of random flame test sampling during production runs as directed by the Authority.
- D. Downlight acrylic lens to be clear prismatic material with ¼" clear lexan non-glare protective cover, and shall be UV stabilized on both sides.

2.05 PLASTIC FOR ILLUMINATED STATION IDENTIFIER SIGNS

- A. Plastic for letters and logo for Station Identifier Signs to be formed of all natural Cellulose Acetate Butyrate (CAB).

- B. Colors for Identifier Sign letters, logo, and background shall be the Authority's standard colors.
- C. Plastic Identifier Sign to have studs or metal threaded posts secured on rear of the letters and logo for attachment of the plastic sign. Length, spacing, and locations of studs as required by manufacturer for installation and attachment. Show studs on shop drawings submitted to the Authority for review and approval.
- D. Plastic as specified for Illuminated Station Identifier Signs to be as manufactured by the following:
 - 1. Gemini, Inc., Cannon Falls, MN.
 - 2. Approved Equal.

2.06 MOUNTING ACCESSORIES

- A. For reinforcing, brackets, angles, channels, support posts, steel tube:
 - 1. Steel plate, bent plates, clip angles, shapes, channels, angles, and bars: ASTM A36/A36M, hot dip galvanized G90 (ASTM B 633 Type GS).
 - 2. Cold-rolled steel sheet: ASTM A 653/A 653M, hot dip galvanized G90, commercial quality.
 - 3. Steel Tubing: Cold-Formed Steel Tubing, ASTM A 500 or Hot-Formed Steel Tubing, ASTM A 501, with hot-dip galvanized coating per ASTM A 53.
 - 4. Steel Pipe: ASTM A 53, galvanized, standard weight and extra heavy.
 - 5. Aluminum plate, pipe: ASTM B 221, Alloy 6063-T6.

2.07 ATTACHMENT DEVICES

- A. Fasteners: Use concealed fasteners where possible. Fasteners exposed to view shall be of tamper-resistant and anti-vibration design. Fasteners to be of stainless steel unless approved otherwise. See drawings for type, size, spacings, locations for each application. Typically, fasteners to be flat head machine screws. Use fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- B. Anchors and Inserts: Use non-ferrous metal, stainless steel, or hot-dipped galvanized anchors and inserts for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, expansion shields, as required, to be set into concrete or masonry work after drilling.
- C. Continuous Hinges: National Lock Co. 56-472, Type 2, or approved equal, stainless steel.
- D. Flexible Sign Hangers: Similar to flexible fixture hangers, cushion type, enclosed and gasketed, eight degree swing in all directions, cushions 40 lbs., supports 250 lbs., 3/4" size, as manufactured by Appleton Electric Company or approved equal. Provide 2 1/2" diameter galvanized pipe to cover pipe hanger where shown on the drawings.
- E. Threaded Pipe Hangers: 1" in diameter, galvanized with nut and washer (to be tack welded to frame).
- F. Provide brackets, collars, clips, and all other accessories required for installation of signs as approved compatible with the sign and various substrates and as submitted and approved. Fabricate brackets and fittings for bracket-mounted signs from steel to suit sign panel construction and mounting conditions indicated. All metal accessories to be stainless steel or hot-dipped galvanized and factory painted to match the sign frames.

- G. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.08 ACCESSORIES

- A. Weathertight gasket: Provide continuous .05" rubber gasket at flanges at all locations where sign face assembly meets sign body or/and as shown on drawings or required for weathertight installation.

2.09 PAINT

- A. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

- B. Galvanizing Repair Paint: High zinc dust content paint for touching up galvanized surfaces, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

- C. Paint over galvanized metal:

- 1. First Coat: Primer over galvanized metal:

- a. Devco: 8502/8520 Mirrolac.
- b. Fuller: 621-05 Blox-Rust Latex Metal Primer.
- c. Glidden: 5205 Glid-Guard.
- d. Moore: IronClad Galvanized Metal Latex Primer 155.
- e. PPG: 90-709 Industrial Enamel.
- f. P & L: Z/F 1003 Supreme Latex Metal Primer.
- g. S-W: Galvite Paint B50W3.

- 2. Second and Third Coats: Gloss alkyd enamel:

- a. Devco: 70XX Mirrolac Alkyd-Urethane Gloss Enamel.
- b. Fuller: 312-XX EPA Compliant Heavy Duty Enamel.
- c. Glidden: 4550 Series Glid-Guard Alkyd Industrial Enamel.
- d. Moore: Impervo Enamel 133.
- e. PPG: 6-282 Speedhide Gloss-Oil Enamel.
- f. P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
- g. S-W: Industrial Enamel B-54 Series.

Color: CTA White or other station color as selected and approved by Authority.

2.10 FABRICATION

- A. General:

- 1. Enlargement or reduction of art shall be done electronically. Original artwork will be provided by the Authority in Adobe Illustrator format.
- 2. Fabricate exposed surfaces uniformly flat and smooth, without distortion, pitting, or other blemishes. Form exposed metal edges to a smooth radius. Grind exposed welds and rough areas to make flush with adjacent smooth surfaces. Provide all sign bodies with tamperproof construction.
- 3. Sign components shall be designed for easy maintenance and replacement.
- 4. Sign production shall not begin until shop drawings have been approved by the Authority.
- 5. Punch, drill, and tap finished members as required for connection to adjoining

work.

6. Provide outdoor sign assemblies designed, tested, and installed to withstand positive and negative wind loading of 40 psf (1.9 kPa) wind pressure loading, in accordance with Chicago Building Code.
7. Provide a protective covering to the front of the signs to avoid damage during shipment and installation.
8. Before delivery to the site, each sign shall be tagged or labeled with the identifying number and installation location as shown in the appendix. Labeling shall be on the back of the sign. Any sign scratched, chipped, stained, or otherwise damaged during fabrication, handling, shipment, storage, and installation shall be replaced at Contractor's expense.

B. Illuminated Signs

1. Closure shall provide sufficient interior space to enclose the means of illumination, its control, and test equipment.
2. Enclosure shall be gasketed, weatherproof, and bug-tight. Illuminated signs shall be UL listed for exterior wet locations.
3. Message compartments in the sign shall be light-tight from all directions, so as to prevent seepage of light between compartments, except the message face. The interior compartments shall be white.
4. Illuminate units in the manner indicated using inductively coupled fluorescent lamp of standard manufacturer, high frequency ballast, insulators and other components. Make provisions for servicing and for concealed connection to the building system.
5. Access to signs for maintenance shall be through a continuously hinged message face door frame held in place by external fasteners. Each hinged door shall have a means of supporting the door in the open position to facilitate maintenance.
6. Electrical Service: Provide to accommodate 120/208 volt, 3 phase, 4 wire, and 120 volt, single phase, as scheduled on drawings. Where 3 phase signs occur, arrange ballasts to evenly distribute the load over all phases.
7. Power Distribution: Provide all internal wiring for ballasts and lamps. Connect to load side of disconnect switch.
8. Voltage Regulation: Provide adequate space within sign enclosure to accommodate transformers for voltage regulation should excessive voltage drop occur.
9. Lamp connected to the ballasts shall remain operating when supply voltage varies plus or minus 10% from normal.
10. Make provisions for concealed connection to the building system. Coordinate the electrical characteristics of signs with those of the power supply provided.
11. Furnish electrical components incorporated in sign construction approved and listed by the Underwriters Laboratories, Inc., and which conform to the Chicago Building Code and the National Electrical Code. Fluorescent lamp holders of high- impact plastic; incandescent lamp holders of porcelain; both with shielded, metal lamp contacts. Fluorescent lamp ballasts shall be CBM approved and shall be of the high power factor type with Class P and internal capacitor protection, designed for outdoor use to provide reliable starting at temperatures down to -40 degrees Fahrenheit. The maximum temperature limit of the ballast shall not exceed manufacturer instructions. Install ballast below lamp in separate thermally isolated compartment. Provide heat sinking or fan cooling if required. Manufacturers shall be Advance, General Electric, Jefferson, or Universal. Size ballasts properly and having capacity to operate the number and type of lamps under continuous outside duty and each ballast clearly marked or labeled to show the following:
 - a. Manufacturer's name and trademark.

- b. Catalog number.
 - c. Input voltage and frequency.
 - d. Current rating.
 - e. Open-circuit voltage.
 - f. Number of lamps to be controlled.
 - g. Nominal current per lamp.
 - h. Type of lamps and power factor.
 - i. Wiring diagram to show correct connections for the various loads.
12. Provide all internal wiring of insulated, stranded copper, appliance wire, not lighter than no. 12 AWG and thermoplastic insulation, of such thickness and composition to provide satisfactory performance under a continuous maximum temperature of 90 degrees C. Color-code wire with white for the ground wire and secondary circuit corresponding to the color of the ballast leads. Provide terminal blocks for interior power wiring connections.
 13. Provide heavy-duty, single pole, toggle switches for local compartment and lamp control as indicated on drawings; also, provide a disconnect toggle switch inside the sign case of each sign, as required by the Chicago Building Code.
 14. Locate ballasts, raceways and other interior components so as to prevent shadows or dark spots on the sign faces. Distribute weight of the ballasts symmetrically to provide a naturally plumb hanging of the signs. Support ballasts and wiring on the bottoms of the sign cases to maintain a minimum clearance of 1/2". Confine ballast lead splices to the ballast junction boxes or contain in the raceways. Strip insulation on wires at connections only as required to properly make connections. Bare conductor overhang at the edge of the base to which it is connected is not allowed. Secure splices and wiring connections to lampholder terminals mechanically and electrically.
 15. Fluorescent lamps shall be of high output type and required length and wattage. The maximum length of a lamp shall be less than 8'-0". The lamp color shall be "cool white". Manufacturers shall be General Electric, ITT, Sylvania, or North American Phillips.
 16. Each compartment of a multi-compartment illuminated sign shall be separately controlled and wired.
 17. Illumination across the face of the sign shall be uniform in brightness when the sign is turned on.

C. Mounting Accessories:

1. Provide mounting accessories including reinforcing, brackets, angles, channels, bent plates, faming, etc. as indicated on the drawings, specified, or as otherwise required for the installation of the signs.
2. Plates, steel tubes, steel channels, steel bars, sheet metal, and all other mounting accessories shall be galvanized after fabrication. Touch up galvanizing as required, apply one coat of primer and two coats of finish paint in the shop.

2.11 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Authority from the manufacturer's standards.

2.12 GRAPHICS

- A. All copy and graphics shall be permanently embedded in the plastic. The resulting signs shall have all graphic elements inseparable from the plastic in which they are embedded. Artwork shall become permanent part of plastic sign so it will not delaminate. Laminated

products will not be accepted.

- B. Lettering for all signs shall be Helvetica Bold. Lettering shall be electronically reproduced via supplied electronic artwork.
- C. Legends shall include letters, numbers, arrows, symbols, borders and other applications shown for sign panels.
- D. After approval of Shop Drawings, the Authority will supply final artwork in Adobe Illustrator format.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to installation, all signs shall be inspected by the Authority. The purpose of this inspection is to verify quality of manufacture and conformance to requirements for the fabrication, color, artwork, etc. of each type of sign. Inspection will be conducted at the Contractor's premises, or at any other mutually agreeable location, within the City of Chicago. The Contractor shall provide the Authority with a minimum of seven working days' notice prior to inspection.
- B. Installer of signs shall verify all locations, sizes, installation and mounting conditions, type of anchorage required and working conditions in the field.
- C. A representative from the Authority may review the existing conditions with the installer prior to installation. The purpose of this inspection is to verify actual locations, method and quality of installation, mounting heights, interference with the installation, and other installation conditions for each sign. The scheduling of this inspection shall be mutually agreed upon by all parties.
- D. After installation, a final inspection in the field will be conducted by the Authority. The purpose of this inspection is to verify quality of installation, correct location of signs, etc. The Contractor shall provide the Authority with a minimum of seven working days' notice prior to inspection.

3.02 INSTALLATION

- A. General: Install signs to match existing locations, heights, and mounting details unless indicated on the drawings or directed otherwise. Variations may be directed by or approved by the Authority's field representative during a pre-installation walk-thru or during the actual installation based on actual field conditions. Use approved mounting methods, mounting accessories, and attachment devices. No glue installations are permitted.
- B. Installation and anchorage to be solid and secure. Provide and install all indicated backer plates, frames, support, posts, hangers, and other mounting accessories. Provide and install any additional steel or wood framing or other support required. Where indicated or required, modify existing frame to accept new sign assembly.
- C. Install signs and all mounting accessories level, plumb, and flush with substrates. Sign surfaces shall be free from distortion or other defects in appearance.
- D. Provide and install all required attachment devices, brackets, pendants and hardware. Fasteners and other accessories shall be as specified for the application. Use expansion anchors, self-tapping screws, pop-rivets, bolts and nuts, etc. as required. Drill as

required. Use countersunk screws where exposed or necessary. Exposed fasteners to be tamper resistant. Weld where indicated with full, tack, or stitch welds.

- E. Installation of Metal Frames, Supports or Hangers:
 - 1. Weld or bolt metal frames, supports, support posts, or hangers directly to the structure, track structure, beam, columns, light poles, railing, canopy fascia, or windbreak as directed. Use expansion anchors for securing frames, supports, or hangers to masonry or concrete.
- F. Installation of Pipe Hangers:
 - 1. Install flexible hangers where indicated, securing the pivot assembly to the canopy structure and to the sign frame or backer plate as directed.

3.03 FIELD PAINTING

- A. Galvanized metals cut or drilled in the field shall have its galvanized finish touched up in the field with approved galvanizing repair paint.
- B. Dissimilar metals: To avoid galvanic action, separate dissimilar metals with approved paint.
- C. Any mounting accessories such as angles, channels, plates, bent plates, clip angles, tubes, posts, etc. that will be exposed to view after installation of the sign, must be field painted to match the pre-finished backer plates. New wood posts and other members shall also be primed and finished to match the backer plates.
- D. Care shall be taken to not get paint on the new signs or any other existing surface.

3.04 CLEANING AND PROTECTION

- A. Signs shall be adequately protected during their delivery and installation to prevent damage by scratches, marring, stains, discoloration, or other causes. The sign faces shall be protected with a protective covering. The signs shall be crated. Damage to any surface during fabrication, handling, shipment, storage, and installation shall be remedied by the Contractor at Contractor's own expense. Replace any damaged signs that cannot be cleaned or repaired.
- B. Before delivery to the site, each sign shall be tagged or labeled with the identifying number and installation location as shown in the specifications. Labeling shall be on both the sign and the protective covering.
- C. At completion of the installation, remove the protective coating and clean soiled sign surfaces, and surfaces against which the new sign has been mounted, in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Authority.

END OF SECTION 10 42 60

SECTION 10 42 90
BRAILLE TACTILE SIGNS

PART 1 GENERAL

1.01 SUMMARY

- A. This specification covers the requirements for furnishing and installing tactile and Braille signs for the Chicago Transit Authority.
- B. This specification is intended to be descriptive, not restrictive, and is solely for the purpose of indicating the type and quality of tactile and Braille signs which would meet the approval of the Authority.
- C. The Contractor shall furnish and install new combination tactile and Braille message signs as required. Unless otherwise requested, signs will display identical tactile and Braille messages. Refer to the sign schedule in the contract drawings for a list of signs to be furnished and installed for this project.

1.02 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 05 Section, "Metal Fabrications".

1.03 REQUIREMENTS

- A. Signs shall meet or exceed the requirements of the Department of justice Title II of the Americans with Disabilities Act of 1990 (ADA, 42 U.S.C. 12181) as updated, amended and appended by federal, state and local governments and agencies of jurisdiction. Included in the act are requirements for color contrast and surface finish.
- B. Tactile and Braille characters shall conform to International Code/Council/American National Standards Institute (ICC/ANSI) standard A117.1, Accessible and Usable Buildings and Facilities. A nominal finished character height of 0.031" (0.79 millimeter, mm) is required by the standard.
- C. Braille characters shall be Grade 2 as determined by National Library Service (NLS), Library of Congress specification #800. The finished characters shall be legible by a Library of Congress certified Grade 2 Braille reader.
- D. The version of all standards, codes and specifications referenced herein that are current on the date of the Invitation to Bid shall apply.

1.04 SUBMITTALS

- A. All approvals prior to the award of contract shall be arranged through the Procurement Administrator indicated on the front sheet of the Contract Documents. Approvals subsequent to the award of contract shall be arranged with the Authority's manager of Signage and Wayfinding. All evaluations, tests, samples and certification shall be at the Potential Bidder's or Contractor's expense.
- B. Additional approval is required for one or more of the following conditions:

1. New sign products
2. Approved products with a change in manufacturer and manufacturing location
3. Approved products that have been recomposed or reconstructed by the manufacturer.

C. Approval prior to Award:

1. All submitted documents and samples shall be marked with the Potential Bidder's identification and part number, the Authority item number, and the manufacturer's name and part number.
2. Pre-award Approval: Pre-award approval by the Authority shall be secured prior to the award of a contract. Pre-award approval shall include an evaluation of the Potential Bidder's sample signs by the Authority.
3. Sample signs shall be manufactured per artwork supplied by the Authority's Graphics & Design Department.
4. Submitted sample pre-award signs shall be representative of the Potential Bidder's proposed production signs. The Authority will evaluate the samples with respect to the requirements of this specification and the intended service.
5. Submitted pre-award samples may be subjected to field and laboratory evaluations. At discretion of the Authority, evaluations may include, but are not limited to, one or more of the following: disassembly, assembly, installation, simulated service, in-service, nondestructive and destructive tests.
6. Evaluations will be performed based on the availability of the Authority's equipment and personnel.
7. At the satisfactory completion of all tests and evaluations, the Potential Bidder's submitted offer will be recognized as an eligible proposal.
8. Pre-award samples shall be submitted no later than thirty (30) days after the date bids are opened. Failure to submit samples within this time limit will be sufficient cause for rejection of the associated bid. Finished sample sign must be submitted for review with respect to size, finish, color, and compliance to this specification. Sample must be approved by Manager, Signage and Wayfinding before any Contract is awarded.

D. Approval after Award:

1. Production approval: Production approval shall be secured prior to the production of each requested sign style. Production approval shall include a verification of the sign artwork by the Authority's Signage and Wayfinding Department.
2. Contractor is required to submit a sample finished sign no later than thirty (30) days after Contract award. The sample will be fabricated using artwork supplied by the Authority's Signage and Wayfinding Department. Artwork will be furnished in Adobe® Illustrator® electronic format.
3. Upon approval of sample sign, Contractor will receive individual artwork to be used to fabricate signs being produced for this project. The artwork will be furnished in Adobe® Illustrator® electronic format.
4. Contractor shall verify accurate receipt of each digital artwork received by returning a paper copy proof of each to Manager, Signage and Wayfinding, located at 567 W. Lake St., Chicago, IL 60661, Telephone 312-681-3660, before any production runs are made. The Authority reserves the right to make revisions to copy (text) or illustrations (Artwork) upon review of proofs at no additional cost.
5. The Contractor shall return two (2) full-size, dated Braille-Embossed paper (hardcopy) proof using Grade 2 Translation of each new or revised sign artwork requested by the Authority. Updates of existing, previously approved sign artwork are included in this requirement.
6. The Contractor shall submit Braille translations within proofs should such translation be lacking in the preliminary artwork supplied by the Authority. CTA sign design numbers do not require Braille translation.

7. Upon acceptance, the Authority will return one paper proof bearing a dated, authorized signature to indicate approval for production.
8. Failure to obtain Authority's production approval prior to sign production shall be sufficient cause for rejection of the associated sign deliveries.
9. Upon approval of paper proof, Contractor shall produce and submit a sample of the finished production sign for inspection with respect to size, color, and compliance to this specification; prior to full production of the signs.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Signs required shall be listed in the Sign Schedule and the Contract Documents with a description, drawing number(s) and, where available, item number(s).
- B. The base sign shall be constructed of a single, homogenous piece of zinc alloy. By weight, the alloy zinc content shall be 98% or greater. To dissuade theft, materials with high salvage value shall not be utilized in the alloy composition.
- C. The sign shall display a surface hardness within the range 85 – 105 Rockwell hardness, H scale (HRH) as determined by American Society for Testing and Materials (ASTM) standard E 18, Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
- D. Signs shall be composed, sized, formatted and styled as specified in the contract release. The Chicago Transit Authority's Signage and Wayfinding Department shall provide sign artwork in an electronic format consistent with Adobe Illustrator software. Unless otherwise requested, the latest version of the artwork shall be used.
- E. Unless otherwise requested, the sign shall have a nominal thickness of 0.13" (3.3 millimeters, mm).
- F. Signs shall be free of sharp edges and protuberances potentially injurious to bare human flesh. The Contractor shall remove all flashing, burrs, and pointed corners.
- G. Unless otherwise requested, the tactile letter font shall be Helvetica Medium.
- H. All characters shall be well defined. Braille characters shall be distinct mounds that yield smooth feel. Tactile characters shall feature dulled edges. Sharp-edged cylinders shall not be used for Braille characters nor round-edge relief for tactile.
- I. All sign surfaces shall be coated. Unless otherwise specified, the top surfaces of tactile and border relief shall be coated with white catalyzed polyurethane. The background, edges and mounting hole circumferences shall be located with dark gray catalyzed polyurethane, compliant with Pantone Matching System (PMS) color swatch 425. The mounting (rear) surface shall be coated with a moisture impervious, acid-resistant catalyzed epoxy of arbitrary color.
- J. Signs shall be finished with a clear, non-yellowing, non-glare matte industrial grade catalyzed polyurethane. The coating shall isolate the sign colored surface coatings from wear, corrosive cleaners, human sweat and body oils.
- K. With fully cured coatings, the sign coloration shall comply with the 70% contrast requirement of requirement 2.9.

- L. Sign mounting holes shall be located 0.02" (0.4mm) or less from the requested true position. M. The sign shall be suitably flushed and neutralized of all etching acids and process chemicals prior to the application of any coating. Applications shall be in accord with the coating manufacturer's recommendations.
- N. The sign message (front) surface shall be parallel to the mounting surface within 0.04" (1.0 mm) or less.
- O. Exposed sign surface shall be smooth. The surfaces shall be free of porosity, pits, sinks and blemishes. Welds and casting seams shall be ground flush with adjacent surfaces.
- P. Finished signs that are less than 6 inches in length, when resting on the back surface shall be flat within a tolerance of plus or minus 1/32 inch measured diagonally. Finished signs shall be free of sharp edges, burrs, or any other defect that can prove hazardous to personnel or detrimental to the mounting process.
- Q. All signs shall have full finish and color coverage with no defects on all surfaces and edges such as discoloration, bubbles, pin holes, chipping or surface crazing.

2.02 ENVIRONMENTAL CONDITIONS

- A. Signs shall be suitable for unsheltered indoor and outdoor use within a temperature range of - 30 deg F to 120 deg F (-34 deg C to 49 deg C).
- B. All signs will be used outdoors and shall be expected to withstand all weather conditions of the Chicago region, for a minimum of ten (10) years with no or minimal fading, cracking, surface crazing, streaking, chalking, peeling, pitting, or delaminating.

2.03 PACKAGING AND IDENTIFICATION

- A. Signs shall be individually packaged. The packaging shall isolate the sign from scratching, staining, scuffing and chipping by adjacent signs.
- B. Should the Contractor elect to furnish signs with identification beyond that herein specified, the identification shall be located on the mounting (rear) surface. The identification shall be confined within a region not to exceed 20% of the available surface. The Authority's sign identification is incorporated in the sign exposed artwork.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to installation, all signs shall be inspected by the Authority. All signs must meet the quality parameters of the approved sample. The purpose of this inspection is to verify quality of manufacture and conformance to requirements for the fabrication, color, artwork, etc. of each type of sign. Inspection will be conducted at the Contractor's premises, or at any other mutually agreeable location. The Contractor shall provide the Authority with a minimum of seven working days' notice prior to inspection.
- B. Installer of signs shall verify all locations, sizes, installation and mounting conditions, type of anchorage required and working conditions in the field.
- C. A representative from the Authority may review the existing conditions with the installer prior to installation. The purpose of this inspection is to verify actual locations, method and quality of installation, dimensions, heights, space limitations, and other installation conditions for each sign. The scheduling of this inspection shall be mutually agreed upon by all parties.
- D. Contractor to verify the existence of any utilities cables or other existing items or construction that may be in the way of the new signs and this installation. Relocate sign as approved to avoid relocation of utilities or interference with the sign as approved by the Authority.
- E. After installation, a final inspection in the field will be conducted by the Authority. The purpose of this inspection is to verify quality of installation, correct location of signs, etc. The Contractor shall provide the Authority with a minimum of seven working days' notice prior to inspection.

3.02 REMOVAL OF EXISTING SIGNS

- A. Removal of existing signs
 - 1. If applicable or as otherwise directed, the Contractor shall remove all existing signs of the type that is being replaced or that are nonconforming. All existing signs shall be turned over to the Authority and delivered to a specific location as directed. Also remove all existing accessories not needed for the new signs. Remove all existing signs and accessories with care so as not to damage the signs or existing surfaces.
 - 2. Existing signs to be removed may be pop riveted, bolted, or welded to its substrate. Unless noted to be re-used, existing backer plates, framing, straps, anchors, support posts, etc. used with the existing signs shall be removed. Other items may have to be removed, relocated, or altered to allow for the installation of the new signs.
- B. Clean surfaces where existing signs have been removed and clean surfaces that are to receive new signs. Remove any projections or obstructions. Do not reuse existing anchorage devices and other accessories.
- C. For any surface where existing signs and their accessories have been removed and the new signs will not cover, touch up the finish and/or paint to match the existing adjacent surfaces.
- D. Contractor shall identify any existing historic landmark or monument type signs. These signs shall not be removed unless approved otherwise in writing by the Authority.

3.03 INSTALLATION

- A. General: Install signs according to Contract documents or to match existing locations, heights, and mounting details unless indicated or directed otherwise. Variations may be directed by or approved by the Authority's field representative during the pre-installation walk-thru or during the actual installation based on actual field conditions and interference. Use approved mounting methods, mounting accessories, and attachment devices. No glue installations are permitted.
- B. Installation and anchorage shall be solid and secure. Provide and install all indicated backer plates, frames, support, posts, and other mounting accessories. Provide and install any additional steel framing or other support or accessories required. Where indicated or required, modify existing to accept new signs.
- C. Install signs and all mounting accessories level, plumb, and flush with substrates. Sign surfaces shall be free from distortion or other defects in appearance. Mounting heights shall be as shown on drawings, as required by codes and consistent throughout project unless indicated otherwise or required to avoid interference and approval by the Authority.
- D. Provide and install all required attachment devices, brackets, supports, and hardware. Fasteners and other accessories shall be as specified for the application. All fasteners and accessories shall be stainless steel unless noted otherwise. Use expansion anchors, self-tapping screws, pop-rivets, bolts and nuts, etc. as required. Drill as required. Use countersunk screws where exposed or necessary. Exposed fasteners shall be tamper resistant. Weld where indicated with full, tack, or stitch welds. Glue installations of any kind are not permitted, including as a means to attach the sign to backer plate.
- E. Installation of backer plate:
 - 1. Directly to Substrate: Attach backer plate directly to wall, column, light pole, railing, windbreak, etc. by welding or using countersunk screws. Hole locations may be new, existing, or existing to be tapped. Use metal spacers behind the backer plate at each screw location where there are obstructions or minor projections at the surface where indicated on the drawings. Use countersunk expansion anchors when securing backer plate to masonry or concrete.
 - 2. To Metal Frames, Horizontal Supports, Vertical Support Posts or railings: Attach backer plate to a frame made up of metal channels or tubes by welding or using countersunk screws. Attach backer plate to metal channel or tube supports, posts, angles, straps, or hangers by welding or using countersunk screws.
- F. Installation of Metal Frames or Supports:
 - 1. Weld or bolt metal frames, supports, or support posts to beam, columns, light poles, railing, or windbreak as directed. Use expansion anchors for securing frames, supports, or hangers to masonry or concrete. Drill and grout or imbed supports in new concrete where indicated.

G. Installation of Signs:

1. Directly to Substrate: Determine that surface is clean and smooth. Secure signs to substrate using stainless steel pop-rivets. See drawings for spacings.
2. To Surface: Surface mounted signs include installations on any flat surface which can be, but are not limited to, walls, canopy support and platform columns, sign frames, and sign supports. Fastening hardware shall be 1/4-20 tamper-resistant machine screw or TORX T27 (with security pin) 1/4-20, T27 with locking hex head nut with 1/4- 20 self-locking hex head nut (nylon insert) or stainless steel rivet, as determined by the Authority.
3. To Metal Frame: Welded metal tube or channel frame with mitered corners shall be slightly larger than sign. Secure sign to frame with pop rivets using approved spacings.
4. To Backer Plate: Metal surface of backer plate shall be clean and smooth with all countersunk screws properly installed. Backer plates shall be same exact size as sign. Secure sign to backer plate using stainless steel pop-rivets or tamper-resistant machine screws as indicated (drill/tap backer plate to accept screws) using approved spacings.
5. Pendant Bracket Mounted Sign: Pendant mountings are generally described as those which require two sign faces, back to back, attached to and supported by metal brackets (or similar metal supports), sandwiched between the two sign faces. Brackets shall be configured to provide proper mounting of sign. Fastening hardware and type of installation shall be equivalent to that which is existing.
6. Bracket-Mounted Units: Provide the manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.
7. Panel Mounted Non-Illuminated signs: Panel mounted signs include installations on any flat or curved surface which can be, but are not limited to, acoustical panels, etc. Fastening hardware shall be 1/4-20 taper resistant machine screws (Tamper Pruf No 14 head) with 1/4-20 self-locking head nut (nylon insert) attached to panel. Glue installations are not permitted.
8. Trim signs as required to fit locations only with approval of Authority. Modify existing sign frames, backer plates, supports, etc. as required for new signs.
9. Provide supports as shown or required for support of tactile and Braille signs. Supports to be stainless steel unless approved otherwise. Supports to be anchored into or to substrates.

3.04 FIELD PAINTING

- A. The pre-finished backer plates shall have their finish touched up as required where exposed to view after installation of the signs.
- B. Galvanized metals cut or drilled in the field shall have its galvanized finish touched up in the field with approved galvanizing repair paint.
- C. Dissimilar metals: To avoid galvanic action, separate dissimilar metals with approved paint.
- D. Any mounting accessories such as angles, channels, plates, bent plates, clip angles, tubes, posts, etc. that will be exposed to view after installation of the sign, shall be field painted to match the backer plates. New wood posts and other members shall also be primed and finished to match the backer plates.
- E. Care shall be taken to not get paint on the new signs or any other existing surface.

3.05 CLEANING AND PROTECTION

- A. Signs shall be adequately protected during their delivery and installation to prevent damage by scratches, marring, stains, discoloration, or other causes. The sign faces shall be protected with a protective covering. The signs shall be crated. Damage to any surface during fabrication, handling, shipment, storage, and installation shall be remedied by the Contractor at Contractor's own expense. Replace any damaged signs that cannot be cleaned or repaired.
- B. Before delivery to the site, each sign shall be tagged or labeled with the identifying number and installation location as shown in the specifications. Labeling shall be on both the sign and the protective covering.
- C. At completion of the installation, remove the protective coating and clean soiled sign surfaces, and surfaces against which the new sign has been mounted, in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Authority.

END OF SECTION 10 42 90

SECTION 10 45 40
ROTOGATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Provide rotogates as required by the Contract Documents. The stainless steel rotogate assembly consists of a manually operated rotating gate with framed barrier, ceiling, and canopy structure. Rotogates may be single type or double type, as shown on the drawings.
- B. Related Work Specified Elsewhere:
1. Metal Fabrications, Section 05 50 00.
 2. Ornamental Metals, Section 05 70 00.

1.03 QUALITY ASSURANCE

- A. Field Measurements: If possible, take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; when taking field measurements before fabrication might delay work, allow for adjustments during installation.
- B. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Qualifications: No work, shop drawings or materials shall be bought or ordered until the manufacturer of the rotogates has been approved by the Authority. The manufacturer/contractor shall comply with the following:
1. The manufacturer shall have at least ten (10) continuous years experience in the manufacture of the type of work under this contract.
 2. The manufacturer's plant shall be open to the Authority's representative for the Authority's inspection. Complete fabrication methods and procedures shall be demonstrated to the Authority upon request.
 3. The manufacturer shall demonstrate that their plant is adequate to handle fabrication and installation within the construction period.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions for products and processes used, including finishes.
- B. Shop Drawings: Prior to fabrication, the rotogate manufacturer shall submit shop drawings to the Project Manager for approval. Shop drawings shall indicate all dimensions, details, installation details, elevations, plans, sections, all components, material list, assembly, etc. of each type of rotogate. Include plans, elevations and details of fittings, connections, and anchorages to other work. Shop drawings shall indicate actual field verified dimensions and conditions. The manufacturer shall make any changes specified in line with the requirements. Approval of shop drawings shall not

release the manufacturer from furnishing the equipment in full compliance with these requirements.

- C. Provide any required templates for anchor and bolt installation by others.
- D. As-built Drawings, Parts Lists, and Instructions: The contractor and manufacturer shall furnish three sets of as-built drawings, maintenance instructions, circuit diagrams, and parts lists at the time of delivery of equipment. Drawings shall enable identification of all parts and subassemblies for ease in future ordering of repair parts.
- E. Samples: Provide samples of stainless steel in finish specified.
- F. Certification: Provision of rotogates, including fabrication and installation, shall be in strict compliance with all safety and code requirements of federal, state, and local government agencies having jurisdiction. Contractor shall submit written certification of all required compliance prior to fabricating and installing.
- G. Manufacturer shall also certify that he has reviewed the proposed locations and applications of the rotogates and that his rotogate would function properly in those locations and under those conditions.
- H. Manufacturer shall also certify that replacement parts for the rotogate will be available for purchase by the Authority after the expiration of the warranty period.

1.05 WARRANTY

- A. Rotogates shall be warrantied for a period of one year after final acceptance for defects in materials, workmanship, and installation and be repaired or replaced to the satisfaction of the Authority and at no cost to the Authority. Rotogates that fail to operate smoothly and as designed shall similarly be replaced within the warranty period.

1.06 DELIVERY & STORAGE

- A. Delivery, Storage and Handling: Material shall be delivered to the project in sealed containers bearing manufacturer's name and material identification. Materials shall be stored in strict accordance with the manufacturer's printed directions.
- B. Protection: Protect materials against damage from mechanical abuse, plaster, salts, acids, staining, and other foreign matter by an approved means during transportation, storage and erection and until completion of construction work. All unsatisfactory materials shall be removed from the premises, and all damaged materials replaced with new materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include but are not limited to the following:
 - 1. Perey Turnstiles, 308 Bishop Ave., Bridgeport, CT. 06610 203-333-9400 (Model "AA" Ful-Stride Roto-Gate).
 - 2. Approved Equal.

2.02 MATERIALS

- A. General: Furnish complete ANSI No. 304 stainless steel rotogate assemblies each with a three wing section consisting of assembled rotor section, arms, assembled barrier section, cage section, floor and ceiling plates.
1. The rotogates shall be so designed and constructed so as to permit convenience passage of persons freely in one direction of rotation and prevent passage in the opposite direction. The double rotogate shall have two separate gates. The direction of travel through the rotogate shall be reversible without requiring additional parts.
 2. The overall height of the rotogates shall be 7'-0". The diameter of a non-handicap single rotogate shall be 5'-6" unless shown otherwise on the drawings. Handicap rotogate, where shown, to be 8'-0" in diameter. The total height of the rotogate cage shall be 6'-7" or as shown on the drawings.
 3. Each rotor shall have three (3) vertical sets of arms, one set per rotor wing, spaced 120 degrees apart on centerline. Each arm shall consist of a single stainless steel section, equally spaced. The maximum vertical space between the horizontal rotor arms for each section shall be 5". The rotor arms shall be minimum 1-1/2" square cross section tubing with minimum .097" thick wall, bolted to malleable cast iron clamps at the rotor post, with the ends of the arms spun welded closed with edges ground and polished smooth. Each arm shall be brushed to No. 4 finish.
 4. Rotor and Barrier Vertical Members shall be 0.25" thick angles. Arms are pinned into rotor with malleable cast iron clamps and secured with 3/8" diameter bolts. Clamps 5-step process plated with certified 50 year salt-fog-chamber test.
 5. The barrier comb sections shall consist of minimum 1-1/2" square cross section (to match arms) stainless steel tubing, minimum .097" thick wall, spaced equally and offset with the rotor arms, bolted to the support post, with the ends of the arms spun welded closed with edges ground and polished smooth and finished to match the rotor arms. The maximum vertical space between the horizontal barrier arms shall be 5" to match the rotor arms. The configuration shall be such that a person should not tend to be caught between the rotor arm section and the barrier section.
 6. The shield assembly or cage is to be constructed with 3 vertical stainless steel "U" channels attached to the floor and ceiling; with 1" stainless steel bands of minimum .38" stainless steel, spaced equally, curved to form the circumference of the rotogate, and welded to the channels. Finish to match the rotor arms. The maximum vertical distance between the bands shall not exceed 5". Alternate barrier materials are a full stainless plate or tempered glass in a stainless steel frame, as indicated on the drawings.
 7. Heel guards on the bottom arms of rotor shall be "U" shaped channels surrounding the lower arms and extending to the floor.
 8. The full round ceiling plate shall be fabricated of stainless steel, minimum 11 ga., attached to internal supports of structural steel channel and the mechanism housing. The internal steel support system, which contains the rotogate controls shall not be open to view. The exterior section shall be brushed to a No. 4 finish and span the entire shield and barrier assembly. Ceiling canopy to be provided with welded stiffeners and structural reinforcements consisting of minimum 0.375" steel angles.
 9. The bottom bearings for the rotors shall be of the friction type to minimize spinning and corrosion. A mechanical clutch mechanism to be used to restrict traffic flow to exit only; using a machined clutch body and hardened 1" thick ratchet assembly. Over-running clutch design, drill rod steel rollers, hardened inner clutch ring and keyway. Hardened steel star gear, steel bearings and 2" thick flame-cut and hardened steel housing. Operation of rotogate shall be silent and resistant to "free-wheeling".
 10. Rotogate to be of heavy duty design and operation, with heavy duty operating mechanism.

11. As required and/or shown on the drawings, The ceiling of the rotogate shall have a fascia extending upward. Fascia shall extend the full perimeter of the ceiling, be of one piece metal, welded as required, reinforced as required, and be of 16 ga. stainless steel, minimum, finish to match other stainless steel. Height of fascia as shown on the drawings or as required by field verified dimensions.
 12. When installed at unprotected exterior locations, the rotogate shall be designed and fabricated to withstand the elements and operate properly under all conditions. The rotogate shall have adequate protection from moisture infiltration of its mechanism and all moving parts.
- B. Protection from Dissimilar Materials: Stainless steel shall be protected from direct contact with dissimilar materials as follows:
1. Dissimilar metals shall be painted with a heavy brush coat of zinc chromate paint.
 2. Stainless steel surfaces in contact with mortar, concrete, or other masonry material shall be given one heavy brush coat of alkali-resistant bituminous paint.
- C. Stainless Steel: All exposed materials used for the manufacture of the rotogate shall be stainless steel. All stainless steel used shall be of the same type, either AISI Type 304, with No. 4 brushed finish unless otherwise indicated.

2.03 FABRICATION

- A. Field Measurements: Before proceeding with fabrication, the supplier/installer shall verify all dimensions and take such measurements as are required for proper fabrication and erection of the work.
- B. Standards:
1. Work under this section shall be executed by a qualified manufacturer. All exposed work shall be professionally finished in materials and workmanship. Field work shall be done by skilled mechanics. Angles and lines shall be straight and true; surfaces shall be smooth and free from all waves and buckles. Do all cutting and drilling necessary for fitting work in place and erect all work in place in a firm, rigid and workmanlike manner.
 2. Shop assembled members shall be welded. No field riveting will be permitted; bolted field connections may be reinforced by welding. All welds shall be ground smooth and flush with adjacent surfaces.
 3. Where welding occurs, it shall be by the electric arc process in accordance with American Welding Society's Code of Arc and Gas Welding in Building Construction.
 4. All welding shall be executed by operators who have been qualified previously by tests as prescribed by the American Welding Society's "Standard Qualification Procedure" to perform the work required.
 5. No flame cutting of steel will be permitted in the field. Members flame-cut in the shop shall be finished to an acceptable appearance equal to a sheared finish. Holes shall not be flame-cut in either shop or field. No cutting of structural shapes shall be done in the field without the consent of the Engineer.
- C. Assembly:
1. Materials shall be properly marked and match-marked where field assembly is required. The sequence of shipment shall be such as to expedite erection and minimize the field handling of materials.
 2. Use care in handling and erection to insure that steel shall not be twisted bent, or otherwise damaged, and should any difficulty be encountered, it shall be immediately reported to the Engineer.

3. Connections at angles, miters and junctions which cannot be forged or welded shall be made with blind screws from the back or other concealed fastenings. Furnish and install all additional clips, angles, braces, framing and supports required for anchoring this work to the masonry or structural frame of building or for supporting other work as shown. provide proper expansion joints in continuous metal work where required, as approved by the Engineer. Exposed work shall be finished smooth and even, with close joints and connections.

2.04 PROTECTION FROM THE ELEMENTS

- A. Provide whatever additional materials or systems necessary to protect the mechanisms of the rotogates and assure continuous proper operation at all times when rotogates are indicated to be installed exposed and without protection from the elements; including rain, snow, ice and cold temperatures.

2.05 PROTECTION OF STAINLESS STEEL FINISH

- A. Provide a transparent polymer film covering for shop fabrication and protection during erection. Film shall be applied with a roller coating and thermal setting technique which when erected in place can be stripped from the finished surface.

PART 3 EXECUTION

3.01 INSPECTION

- A. Contractor shall examine the areas and conditions under which rotogates are to be installed and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide all required support necessary for the installation of the rotogate, including any required framing or blocking required below the floor or above the ceiling necessary to secure the rotogate to. Provide and install any additional stainless steel bars or barriers required to enclose the space and support the rotogate.

3.03 INSTALLATION

- A. Install rotogate in accordance with manufacturer's directions and under the supervision of a factory representative. Equipment shall be installed plumb, square, in proper alignment and securely anchored in the building construction.

3.04 ERECTION

- A. Furnish erection equipment, tools and anchorage items for proper installation of the work.
- B. Erect and assemble work in place in proper sequence with the installation of related
- C. Use approved anchoring devices, screws and bolts, in finish to match rotogate.

END OF SECTION 10 45 40

SECTION 10 60 50
WIRE MESH PANELS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes providing all labor, materials, and equipment required to provide and install galvanized wire mesh panels and frames for barriers at elevator sheave cables.

1.03 RELATED SECTIONS

- A. The following Sections contain requirements that relate to this Section:
1. Division 05 Section, "Metal Fabrications".

1.04 REFERENCES

- A. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.
- B. ASTM A36 – Standard Specification for Carbon Structural Steel.
- C. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- F. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. AWS D1.1 – Structural Welding Code – Steel.
- H. AWS D1.3 – Structural Welding Code – Sheet Steel.
- I. SSPC Paint 20 – Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).

1.05 DEFINITIONS

- A. The types of weaves for the wire mesh specified in this Section are as illustrated and defined in ASTM E 437 and its Appendix X 4.2:
1. Plain Weave: Wires pass over one and under the next adjacent wire in both directions.
 2. Intercrimped: Similar to plain weave with extra crimps between the intersections.

1.06 SUBMITTALS

- A. Product Data for each type of product specified, consisting of manufacturer's specification, technical data, construction details, material descriptions, and installation instructions.
- B. Shop Drawings showing fabrication and installation of wire mesh, wire mesh panels, and framing for all applicable applications; including plans, elevations, profiles, and large-scale details showing individual components; attachment to surrounding materials and surfaces; accessory items. Provide location template drawings for items supported or anchored to permanent construction. Show elevations, plans, sections and details. Indicate actual field verified dimensions and installation conditions.
- C. Samples of a 12-by-12-inch wire mesh panel constructed of specified frame members and wire mesh.
- D. For all components including framing and wire mesh; provide product data, application instructions and recommendations, and certification for hot-dipped galvanizing materials and application.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: Engage a firm with at least five years experience in fabricating wire mesh panels similar to those indicated for this Project and that have a record of successful in-service performance for similar installations.
- B. Finisher's Qualifications: Engage firms with at least five years experience in hot dip galvanizing materials similar to the products indicated for this Project.
 - 1. The Authority has the option to send a representative to the fabricator's plant to inspect the galvanized material and review the fabrication and finishing process.
- C. Installer Qualifications: Arrange for installation of wire mesh panels and frames specified in this section by same firm that fabricated them or approved by them.
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver welded wire items with cardboard protectors on perimeters of panels, palleted or crated to provide protection during transit and site storage. Do not use nonvented plastic.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations for wire mesh products by accurate field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication and delivery schedules with construction progress to avoid delaying the Work. Verify locations of all obstructions.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee location dimensions and proceed with fabricating wire mesh products without field measurements. Coordinate wall, column, floor, ceiling and stair construction to ensure that actual location dimensions correspond to guaranteed

dimensions.

1.10 COORDINATION

- A. Coordinate installation of anchorages for fabrications supported or anchored to permanent construction. Furnish setting drawings, templates, and all directions for installing anchorages. Deliver such items to the project site in time for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Acorn Wire and Iron Works, Inc.
2. California Wire Products Corp.
3. Cambridge Wire Cloth Company.
4. F. P. Smith Wire Cloth Co.
5. GKD-USA.
6. G-S Company (The).
7. Hoosier Fence Co., Inc. (The).
8. Indiana Wire Products, Inc.
9. Kane Manufacturing Corp.
10. Kentucky Metal Products Co.
11. King Wire Partitions, Inc.
12. Lakeside Wire and Iron Co.
13. Miller Wire Works, Inc.
14. Space Guard Products.
15. Sterling Dula Architectural Products, Inc.
16. TWP Inc.
17. Wire and Iron Products, Inc.
18. Approved Equal.

2.02 MATERIALS

- A. Galvanized Steel Wire: ASTM A 641.
- B. Steel Channels, Angles, Plates, and Bars: ASTM A 36.
- C. Galvanized Steel Sheet: Commercial-quality, hot-dip-coated steel sheet, ASTM A 653, with G 60 or A 60, coating.
- D. Square Steel Tubing: Cold-formed structural steel tubing, ASTM A 500 hot-dip galvanized coating per ASTM A 53.
- E. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as material supported, unless otherwise indicated.
- F. Fasteners: Provide Type 300 series stainless steel fasteners, unless noted otherwise. Select fasteners for the type, grade, and class required.
- G. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy welded.

2.03 PAINT

- A. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight and complying with DOD-P-21035 or SSPC-Paint-20.

2.04 METAL SURFACES

- A. General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials where exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and variations in flatness exceeding those permitted by referenced standards.

2.05 WIRE MESH PANELS

- A. General: Provide steel wire mesh panels for installation in barriers and gates including wire, framing, connectors, fasteners and other items as required for a complete installation; as indicated on the drawings, or as necessary for panels, barrier and gate installations. Panels and framing members to be hot dipped galvanized after fabrication.
- B. Mesh: 0.162 inch (4 mm) diameter, inter-crimped steel hot-dipped galvanized wire woven. Spacing of horizontal wires to be 0.500 inches on center horizontally and spacing of vertical wires to be 3.000 inches on center vertically. Securely weld the ends of continuous horizontal and vertical wires to the frame members. Vertical wires to be plumb, true vertical, parallel to jamb of frame. Horizontal wires to be perpendicular to vertical wires.
- C. Frames: Provide framing, including frame around or provide cutouts for beams, and other items shown or necessary for panel and barrier installation. Finish edges of cutouts to provide a neat, protective edge.
 - 1. Frame Members (for attachment of steel wire): 1-1/4 inch x 3/4 inch x 0.1046 inch (12 gage) cold-rolled steel channel with bolt holes spaced not more than 18 inches o.c. along center of framing.
- D. Shop fabricate wire mesh panels. Assemblies or sizes of fabrications to be as indicated on the drawings; to fit within barrier or gate framing; or largest sizes practical for galvanizing and shipping. See drawings and approved shop drawings for fabrication details and sizes. Verify in the field all dimensions and conditions.
- E. Shop fabricate frame work for wire mesh panels. Steel frame members for wire mesh panels to be mitered at corners and fully welded together at all sides of joints. Grind welds smooth, leaving no evidence of joint and remove splatter.
- F. Wire mesh end strands to be inserted into holes pre-drilled into the back of the channels at spacing vertically and horizontally as required to correspond to the wire mesh spacing. Verify spacings and verify size of hole for insertion of the wire. Wire mesh to be welded at each hole; wire strand to be welded all around; weld to cover hole completely to avoid water leakage.

2.06 FABRICATION - GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated on drawings but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various

components of each metal fabrication.

- B. Form exposed work true to line and level with accurate angles, curves and surfaces and straight sharp edges. Form to required shapes and sizes. Form exposed connections with hairline joints, flush and smooth. Unless otherwise noted, fabricate framing with mitered corner joints. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.
- C. Shear and punch metals cleanly and accurately. Remove burrs.
- D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Remove sharp or rough areas on exposed surfaces.
- F. Weld corners and seams continuously to comply with AWS specifications and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent. Grind exposed welds flush and smooth to match and blend with adjoining surfaces.
- G. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- H. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- I. Cut, reinforce, drill and tap metal work as indicated to receive finish hardware, screws, and similar items. Provide bolts, hardware, and accessories for complete installation.
- J. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- K. Pre-drill any bolt holes needed for attachment of mesh panel section to the framing or structure. Weld on any brackets, tabs, angles, sleeves, or other required attachment devices. Extend and fabricate ends of framing as detailed on shop drawings for attachment of assemblies to structure.
 - 1. For connecting panels to framing, fabricate insert panels with welded tabs and slotted holes for alignment with welded tabs on metal framing.
- L. Provide weep holes as required to provide drainage from void between channel and bottom railing member, barrier/gate frame, to drain any accumulating moisture and to facilitate proper galvanizing. Provide 1/2" diam. weep holes in every mesh section. Provide two holes when mesh sections are more than 1'-0" wide.
- M. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by welded wire panel manufacturer to avoid bowing or other

deformity. Indicate stiffener locations on the shop drawings for approval. Weld horizontal stiffeners to vertical framing.

2.08 GALVANIZING OF STEEL

- A. After inspection and approval and before leaving the shop, all steel and steel mesh exposed in the finish work shall be cleaned by grit or sandblasting of mill scale, rust, weld slag or flux deposit, dirt, and other foreign matter to a "commercial bright" finish in accordance with SSPC SP-6. Surface concealed on the finish work shall be power brush cleaned of loose foreign matter in accordance with SSPC SP-3. Remove oil and grease deposits by solvent.
- B. Immediately after cleaning all steel members, fabrications, mesh panels, plates, angles, attachment fabrications, and all attachment devices shall be completely hot dipped galvanized conforming to ASTM A123 and as recommended by the American Galvanizers Association. Steel tubes and other hollow members shall be galvanized on all sides, inside and outside. Galvanize after fabrication of gates and panels to the greatest extent possible. Galvanize after drilling holes, welding and other fabrication procedures to the greatest extent possible.
- C. After galvanizing, all metal and fabricated sections shall be inspected and any imperfections in the galvanizing shall be remedied. Touch-up with approved galvanizing repair paint all welds, cuts, drilled holes, attachments, scratches, etc. so all exposed surfaces are fully galvanized. Apply galvanizing repair paint with a brush at proper thickness, and according to manufacturer's recommendations.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors embedded in concrete construction. Coordinate delivery of such items to Project site.
- B. See drawings for locations and extent of wire mesh panels.

3.02 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing wire mesh framing and gates to in-place construction.
- B. Provide and install additional framing as required to secure framing and gates to structure. Provide and install additional corner posts, capping bars, floor shoes, etc. as shown or required.
- C. Placement: Set wire mesh frames or gates accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- D. Fit exposed bolted connections accurately together to form hairline joints. Erect and securely fasten into place for rigid installation and to meet design loadings. Comply with drawings and approved shop drawings.
- E. Provide additional field bracing as shown or necessary for rigid, secure installation. Installer to provide additional clips and bracing as required.

- F. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.

3.03 FIELD TOUCH-UP OF GALVANIZING

- A. Any areas where the galvanizing has been compromised during installation and areas around field welds shall be thoroughly cleaned and re-galvanized with galvanizing repair paint. Follow manufacturer's directions for preparation and application.
- B. Areas of the metal surfaces where the galvanizing has been repaired and areas of damaged and abraded spots to be cleaned.

END OF SECTION 10 60 50

SECTION 10 80 00
TOILET ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes toilet room accessory items as scheduled, including the following:

1. Toilet Tissue Dispensers.
2. Paper Towel Dispenser and Trash Receptacle.
3. Grab Bars.
4. Mirror and Shelf.
5. Soap Dispenser.
6. Double-Prong Robe Hook.
7. Mop and Broom Holder/Utility Shelf

- B. Related Sections include the following:

1. Division 4 Sections, Structural Glazed Facing Tile.

1.03 SUBMITTALS

- A. General: Submit the following according to conditions of contract and Division 01 Specifications Sections:

1. Product data for each toilet room accessory item specified, including construction details relative to materials, dimensions, gauges, profiles, mounting methods, specified options, and finishes.
2. Samples of each toilet room accessory item to verify design, operation, and finish requirements. Acceptable full-size samples will be returned and may be used in the Work.
3. Schedule indicating types, quantities, sizes, and installation locations (by room), mounting heights, for each toilet room accessory item to be provided for the project.
4. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
5. Maintenance instructions including replaceable parts and service specifications.

1.04 REFERENCES

- A. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
- C. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

- D. ASTM B456 – Standard Specification for Magnetic Particle Examination of Large Crankshaft Forgings.
- E. ASTM C1036 – Standard Specification for Flat Glass.
- F. ASTM F446 - Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

1.05 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that shall be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Authority.
- C. Electrical Components: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.06 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.
- B. Deliver inserts and anchoring devices set into masonry as required to prevent delaying the Work.

1.07 WARRANTY

- A. Mirrors: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within a warranty period of fifteen (15) years from date of Final Acceptance.
- B. Other Accessories, Materials and Work: Submit a written warranty executed by the various manufacturers and the Contractor, agreeing to replace any accessories, materials or work that becomes defective, inoperative, dislodged, loose, or its finish becomes defective due to defective materials or workmanship within a warranty period of one (1) year from date of Final Acceptance.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide toilet room accessories by one of the following:
 - 1. A & J Washroom Accessories.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. General Accessory Manufacturing Co.
 - 6. McKinney/Parker.

2.02 MATERIALS, GENERAL

- A. Stainless Steel: ASTM A 666, Type 304, with satin No. 4 finish, 0.034-inch (22-gauge) minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 1008, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- E. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- F. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- G. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.
- H. Mirror Glass: Nominal 0.23-inch thick, conforming to ASTM C 1503, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, stainless steel, or of galvanized steel where concealed.

2.03 TOILET TISSUE DISPENSERS

- A. Toilet Tissue Dispenser: American Specialties Model No. 0042 or equal; for jumbo rolls. Surface mounted with concealed anchorage #304, stainless steel, satin finish, 22 gauge one-piece, seamless construction. Unit shall be equipped with 18 gauge hood hinged to shell. Spindle shall be chrome plated plastic with a heavy duty internal spring. Approximate size of unit to be 11 inches by 5 inches.

2.04 GRAB BARS

- A. Stainless Steel Type: Provide Type 304 Stainless Steel grab bars with wall thickness not less than 0.05 inch (18 gauge) and as follows:
 - 1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 - 2. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
 - 3. Gripping Surfaces: Smooth, satin finish.
 - 4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
- B. Grab bars to be firmly secured to structure of wall to sustain loads and pulling forces with manufacturer's approved or provided mounting kits and fasteners.
- C. Concealed Mounting Flanges: Provide Stainless Steel, Type 304, 1/8" thick plate; end flanges 2" X 3 1/8" with two holes for attachment to wall. Intermediate flanges 2 5/8" X 3 1/8" wide X 3 1/8" diameter.
- D. Snap Flange Covers: Provide Type 304, 22 gauge (0.8mm) Stainless Steel with satin finish 3 1/4" diameter X 1/2" deep. Each cover snaps over mounting flange to conceal mounting screws.

2.05 MIRROR UNITS

- A. Glass Mirror with Stainless Steel Angle Frame: Mirror shall have a one-piece, type 304 stainless steel angle frame, $\frac{3}{4}$ " x $\frac{3}{4}$ ", not less than 0.04 inch (20 gauge), with continuous integral stiffener on all sides and beveled front to hold frame tightly against mirror, corners shall be mitered with hairline joints, heliarc welded, ground, and polished smooth; all exposed surfaces shall have satin finish. All edges shall be protected by plastic filler strips and the back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 3/16" thick polyethylene padding. Galvanized steel back shall be not less than 0.034 inch (22 gauge) and full mirror size. Back shall have integral one-piece, galvanized steel, horizontal hanging brackets located at top and bottom for mounting on concealed rectangular wall hanger and to prevent the mirror from pulling away from the wall and for a rigid, tamperproof and theft-proof installation. Spring action locking devices secure mirror to concealed wall hanger. There shall be no exposed screws or bolts. Mirror shall be removable from wall hanger for re-glazing mirror.
- B. Mirror shall be 24" x 36". Integral stainless steel shelf to be 5 inches deep.

2.06 LIQUID SOAP DISPENSER

- A. Soap Dish: Surface-mounted, wall-mounted, vandal proof design, satin-finished, type 304, 20 gauge, stainless steel soap dispenser with rectangular wall bracket equipped with backplate for concealed mounting. Tumbler type lock. Stainless steel cover with unbreakable window type refill indicator. Stainless steel piston, springs, and internal parts designed to dispense soap in measured quantity by pump action. Minimum 40 ounce capacity tank.
1. Soap Valve: Designed for dispensing soap in liquid form.
 2. Valve shall be operable with one hand and with less than 5 pounds of force to comply with barrier-free accessibility guidelines.
 3. Provide four (4) sets of keys for the soap dispenser lock.
- B. Surface mounted soap dispenser to be Bobrick B-2111 (vertical) or B-2112 (horizontal) or approved equal.

2.07 ROBE HOOK

- A. Surface Mounted Double-Prong Robe Hook: Heavy-duty satin finished type 304 stainless steel double-prong robe hook. Flange and support arm shall be 22 gauge and equipped with a concealed, 18 gauge mounting bracket that is secured to a concealed, 19 gauge wall plate with a stainless steel setscrew. Cap shall be 14 gage welded to the support arm.

2.08 PAPER TOWEL DISPENSER AND TRASH RECEPTACLE

- A. Semi-Recessed Receptacle Unit: Stainless steel unit fabricated of type 304, 22 gauge, stainless steel with no. 4 satin finish. Hemmed edges for safety. Waste receptacle provided with hooks to hang reusable, heavy duty vinyl liner, minimum 12 gallon capacity, secured in place with tumbler lock. Face trim to be 1" wide formed from one piece with no miters, welding or open seams and have ¼" square return to wall. Structural assembly of all components shall be of welded construction. Unit to be recessed 4" and extend beyond the wall 4". Approximate overall size including trim to be 17" wide X 30" high. Mount unit in wall recess using no. 10 self tapping screws through concealed mounting holes provided.
- B. Surface Mounted Receptacle Unit: Stainless steel unit fabricated of type 304, 20 gauge, stainless steel with no. 4 satin finish. Hemmed top edge with return to inside. Waste receptacle provided with hooks to hang reusable, heavy duty vinyl liner, minimum 12.8 gallon capacity. Structural assembly of receptacle shall be of continuous and seamless welded construction. Unit shall have gently radiused front vertical edges and may have a bowed front face. There shall be no exposed fastening devices or spot welded seams. Approximate overall size to be 15" wide X 24" high X 9" deep maximum. Receptacle shall be screw mounted to the wall through keyhole slots with concealed heavy duty type 304 stainless steel reinforcement straps and concealed theft resistant locking screws.
- C. Surface Mounted Corner Receptacle Unit: Stainless steel unit fabricated of type 304, 22 gauge, stainless steel with no. 4 satin finish. Hemmed top edge with return to inside. Waste receptacle provided with hooks to hang reusable, heavy duty vinyl liner, 16 gallon capacity. Structural assembly of receptacle shall be of continuous and seamless welded construction. There shall be no exposed fastening devices or spot welded seams. Approximate overall size to be 15" wide along each wall X 24" high X 4" extending out from the wall maximum. Receptacle shall be screw mounted to the wall through keyhole slots on back of unit with concealed theft resistant locking screws.
- D. Trash receptacles shall be as manufactured by American Specialties, Inc., Yonkers, New York or an approved equal.

2.09 MOP AND BROOM HOLDER/UTILITY SHELF

- A. Mop and Broom Holder/Utility Shelf: Combination unit with 0.05-inch (18-gauge), Type 304, stainless steel shelf with 1/2-inch returns, 0.062-inch (16-gauge) support brackets for wall mounting. Provide 0.062-inch (16-gauge) stainless steel hooks for wiping rags on front of shelf, together with spring-loaded, rubber hat, cam-type mop/broom holders; 1/4-inch-diameter stainless steel drying rod suspended beneath shelf. Provide unit 36 inches long, 6 inches deep and complete with four mop/broom holders and three hooks.
- B. Provide two triangular brackets, same material as shelf, welded to shelf underside, to support the shelf.

2.10 UNDERLAVATORY GUARDS

- A. Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
- B. Material for underlavatory guards to be antimicrobial, molded-plastic, color white.
- C. Manufacturers:
 - 1. Plumberex Specialty Products, Inc.
 - 2. TCI Products.

3. Truebro, Inc.
4. Approved Equal.

2.11 ACCESSORIES

- A. Hardware and accessories: Manufacturer's standard design, heavy-duty hardware and accessories.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications.

2.12 FABRICATION

- A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Authority, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.
- C. Surface-Mounted Toilet Room Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- D. Recessed Toilet Room Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- E. Keys: Provide universal keys for access to toilet room accessory units requiring internal access for servicing, re-supply, etc. Provide minimum of six keys to Authority's representative.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install toilet room accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as specified by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated. Secure solidly to structural substrate.
 1. Mounting height for hand dryers to be 37" from floor to bottom of dryer.
 2. Mounting height for trash receptacles:
 - a. Semi-recessed receptacle unit: Top of unit 43" above floor.
 - b. Surface mounted receptacle unit: Top of receptacle maximum 40" above floor.

- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars firmly with concealed anchorage and manufacturer's approved or supplied mounting kits and fasteners to structural wall, structural blocking or structural framing to withstand a load of at least 250 lbf in any direction, complying with ASTM F 446. Install grab bars according to manufacturer's directions and recommendations.
- D. All toilet room accessories shall be secured to solid substrate, not into hollow spaces. Provide wall reinforcing as required for solid anchorage of all accessories.
- E. Provide electrical supply and connection for electric hand dryer as required and according to code.

3.02 ADJUSTING AND CLEANING

- A. Adjust toilet room accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 80 00

SECTION 10 81 00
PIGEON CONTROL SYSTEM

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Design Requirements: Measure carefully the width of the surface and determine the appropriate mounting system as determined by site conditions and mounting surface.

1.02 SUMMARY

- A. Provide labor, materials and supervision to install pigeon control system to the surface of the platform canopy as indicated in the Drawings. The bird wire shall stop pigeons, seagulls, and larger birds from landing and roosting on the building structure.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Furnish products from one manufacturer for entire project.
- B. Obtain all technical information from the manufacturer.
- C. Utilize authorized Installers who are knowledgeable in pigeon control product installations.
- D. Installer shall visit the site to gather all information of existing site conditions.

1.04 SUBMITTALS

- A. Product Data: Submit all descriptive information from the manufacturer including catalogs, installation instructions and other descriptive material.
- B. Warranty: Provide Warranty on Material and Installation.
- C. Samples: Provide samples of each type of hardware, including proposed fastening methods.
- D. Shop Drawings: Detail system components and their relationship to the structure.
- E. Provide statement by official indicating that they are a certified installation company.

1.05 PRODUCT HANDLING

- A. Protect materials from damage before, during and after the installation.

1.06 PROJECT CONDITIONS

- A. Coordination: Furnish all anchoring devices required to fasten system to and around existing building structure. Coordinate installation with existing conditions and within on – site tolerances.
- B. Visit site and field measure prior to fabrication and delivery of materials.

1.07 WARRANTY

- A. Product shall carry a minimum 5-year guarantee against U.V. breakdown.

- B. Installation shall be guaranteed for 2 years.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

- A. Bird-B-Gone Bird Wire 2000 - Modular Post and Wire System.

2.02 MATERIAL

- A. Wire: 0.45mm 1 x 7 stainless steel wire, U.V. stabilized clear nylon coated to 0.7mm finished diameter.
- B. Crimps: Nickel-plated copper.
- C. Metal Hardware: 316-grade stainless steel.
- D. Plastic Hardware: High impact U.V. stabilized thermoplastic.
- E. Number of Rows: As determined by the manufacturer and based on project conditions.
- F. Mounting System: As determined by the manufacturer and based on project conditions.

2.03 MOUNTING SYSTEMS

- A. Steel: Use stick-on bases with an outdoor construction adhesive. Adhesive should be allowed to dry overnight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the installation area and note any detrimental or hazardous work conditions. Notify contracting officer or inspector of the detrimental work conditions.
- B. Do not proceed with the installation until conditions are corrected.

3.02 SURFACE PREPARATION

- A. Surface should be thoroughly cleaned and free of bird droppings, nesting materials, rust, peeling paint or other debris.
- B. Remove or repair articles that may damage product after installation, including overhanging foliage, brush and loose parts on the structure.

3.03 INSTALLATION

- A. Install as recommended by the manufacturer.
- B. Pigeon control system should be installed correctly, covering the entire depth of the surface, not just the perimeter.
 - 1. Follow contours and angles closely.
 - 2. Space materials in accordance with manufacturer's recommendations.

3.04 INSPECTION

- A. Visually inspect for any signs of poor installation, including loose screws, fasteners or un-removed debris.
- B. Immediately correct and repair.

END OF SECTION 10 81 00

SECTION 11 24 24
ACCESS SUPPORT EQUIPMENT
AND FALL RESTRAINT EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Section Includes:

1. Horizontal fall restraint cable system including:
 - a. System design
 - b. Cable
 - c. Intermediate pass-thru anchors
 - d. Terminating anchors
 - e. Energy absorber

- B. Related Sections

1. Division 5 Section "Structural Steel Framing" for new steel framing for anchors and davit bases.
2. Division 7 Section "Joint Sealants" for related sealants.

1.03 REFERENCES

- A. Publications listed herein are part of this specification to extent referenced.

1. American Institute of Steel Construction (AISC)
 - a. AISC Publication Load and Resistance Factor Design for Structural Steel Buildings
 - b. AISC Specifications for the Design of Cold-Formed Steel Structural Members
2. American Society for Testing and Materials (ASTM)
 - a. ASTM A36 Specification for Structural Steel
 - b. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware
 - c. ASTM A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - d. ASTM A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - e. ASTM B209-04 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - f. ASTM B221-02 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Wire, Shapes, and Tubes
 - g. ASTM B308/B308M-02 Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
3. American Welding Society (AWS)

- a. AWS D1.1 Structural Welding Code
4. Occupational Safety and Health Standards
 - a. ANSI/IWCA I-14.1-2001 Window Cleaning Safety
 - b. 1910 Subpart D (Walking and Working Surfaces)
 - c. 1910.66 Appendix C (Personal Fall Arrest)
 - d. 1910.66 Subpart F (Powered Platforms)
 - e. OSHA procedures and precautions for employees using descent control equipment.

1.04 SYSTEM DESCRIPTION

A. Anchorage Design Requirements

1. Safety anchor system design shall comply with current OSHA, ANSI, and local regulations pertaining to window cleaning and fall protection in accordance with sections 1.1, 1.2, and 1.3.
2. Anchor system shall provide independent fall arrest anchorages in addition to suspension line anchorages for each descent location as required by OSHA and ANSI requirements.
3. System shall be designed to be compatible with current window cleaning industry standard equipment (examples: rope descent systems, boatswain chairs, swing stages, transportable suspension devices).
4. Structural design requirements of anchorages and tie-back
 - a. Anchorage shall be capable of sustaining a minimum ultimate load of 5,000 lbs., in any direction the load may be applied, without fracture or failure.
 - b. Anchorage shall be capable of sustaining a minimum proof load of 2,500 lbs., in any direction the load may be applied, without permanent deformation or damage to anchorage.
 - c. Anchorages shall be designed with a minimum 1,250 lb. working load, in any direction the load may be applied.
 - e. Parapet or guardrails subject to direct loading by workers' ropes, cables, or other equipment shall be designed to withstand 1,800 lbs without damage to either the structure or the rigging component in contact with it.
5. Locate primary support and fall arrest anchors in conjunction with areas on façade of building needing to be serviced. Consideration shall be given to the type of suspension equipment that will be used at the building and conditions such as workers' reach, rigging methods, and roof edge conditions. Anchorages shall be unobstructed and located behind and in line with equipment or portion of building they are intended to service.

- B. Horizontal fall restraint cable system
1. The Horizontal fall restraint cable system (HFRCS) shall allow up to two users to traverse the length of the cable span, each using a single lanyard for traveling along the cable spans. Turns in the HFRCS will require a double lanyard. The HFRCS shall be designed for two users using an energy absorbing lanyard, which limits the force applied to the HFRCS to 900 lb. or less.
 2. HFRCS spans shall not exceed 100 feet long.
 3. The horizontal line shall be constructed of 3/8" x 7 x 19 stainless steel or galvanized aircraft cable, commercial grade per specification SD 118 and Fed. Spec. RR-W-410, construction grade, with an average breaking strength of not less than 14,400 lbs.
 4. Horizontal lines shall be permanently attached to anchors with 2 non-corrosive permanently swaged fittings swaged to manufacturer's specifications at each termination. Swages shall be verified not to loosen under load. Load capacity of one swage shall exceed strength of wire rope.
 5. Horizontal lines must be attached to anchorages designed to be capable of supporting a minimum 5,000 lb. However, the HFRCS cable and anchorages shall be independent of anchorages used for suspension in accordance with Section 1.4(A) Anchorage Design Requirements.

1.05 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product proposed
1. Test report certified by a professional engineer
 2. General product data
 3. Detailed drawings of equipment proposed
 4. Installation instructions
- B. Shop Drawings
1. Submit scaled shop drawings showing location plan of all support equipment and sections detailing all parts and accessories.
 2. Clearly specify equipment dimensions, materials, fabrication details, hardware, and installation instructions.
 3. Include notes with guidelines of proper use of system.
 4. Equipment location plan to include identification number next to each piece of equipment, i.e. (anchors and davits) that are permanently affixed to a structure.
 5. Field welds shall be indicated on equipment details using AWS symbols and showing length and size. Auxiliary views shall be shown to clarify welding as required.
 6. Shop drawings shall be prepared under supervision of a registered professional engineer and shall bear the engineer's seal and signature. Professional engineer shall be licensed in jurisdiction where project is located. Include P.E. certified report of tested equipment.
- C. Quality Assurance Submittal Certificates
1. Provide documentation verifying company's amount of experience and successful performance in design, fabrication, and installation of permanent window washing equipment.
 2. Submit listing of company's installations representing similar scope and complexity to project requirements for previous 10 years. List shall include information as follows:
 - a. Project name and address

- b. Name of owner
 - c. Name of contractor
 - d. Name of architect (if applicable)
 - e. Date of completion
3. Provide documentation verifying that installers have been trained by the manufacturer and are competent.
- D. Contract Close-out Submittals
1. Operation and Maintenance
 - a. Provide a safety inspection logbook for yearly inspections. Log book shall include a certification of compliance letter. The certification of compliance shall state that access system is in compliance with current OSHA regulations and ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standard.
 2. Project Record Document Data
 - a. Record anchor locations and details.
 - b. Submit 2 copies of a reduced, plastic laminated Project Record Drawing showing as-installed anchor locations, details, and instructional text in English (and Spanish upon request). Post one copy on interior of each roof door or adjacent to exit on roof; owner shall establish exact location.
 - c. Submit a letter of certification by a registered professional engineer licensed in jurisdiction where project is located verifying that installed anchors and system are in compliance with OSHA and ANSI requirements as specified. Each piece of access equipment dedicated to the building shall be tested on site under the supervision of a P.E. in accordance with ANSI/IWCA I-14.1-2001 Window Cleaning Safety and Summit Anchor Co. test procedures.

1.06 QUALITY ASSURANCE

A. Qualifications

1. Provide products from a company specializing in design, fabrication, and installation of permanent window washing equipment with a minimum of 5 years documented experience. Companies like miscellaneous metal fabricators not normally engaged in design and fabrications of suspended access equipment are not acceptable.
2. Manufacturer and installer shall have specific liability insurance (products and completed operations) in an amount not less than \$5,000,000.
3. Installer(s) shall be trained or qualified by manufacturer in installation techniques and procedures of permanent window washing equipment and shall demonstrate a minimum of 5 years successful experience in such installation.

B. Regulatory Requirements

1. Comply with Occupational Health and Safety Standards:
 - a. ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standard
 - b. 1910 Subpart D (Walking and Working Surfaces)
 - c. 1910.66 Appendix C (Personal Fall Arrest)
 - d. 1910.66 Subpart F (Powered Platforms)
 - e. OSHA Procedures and precautions for employees using descent control equipment.
2. Welding shall comply with AWS D1.1 and shall be performed by welders qualified to work in jurisdiction where project is located.
3. Comply with AISC publications:
 - a. Load and Resistance Factor Design for Structural Steel Buildings
 - b. Specifications for the Design of Cold-Formed Steel Structural Members

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original unopened packaging.
- B. Storage and Protection
 1. Store materials in a protected area away from construction activities.
 2. Clean bolts that have become dirty before installing.
 3. Special care must be taken with stainless steel since not compatible with many chemicals and materials.
 4. Do not install damaged materials. Remove damaged materials from site.

1.08 SEQUENCING AND COORDINATION

- A. General contractor is responsible for coordinating the schedule for producing shop drawings, fabricating suspended access equipment, and installation. General contractor shall allow three weeks for delivery of shop drawings and three weeks to deliver equipment upon approval of shop drawing by general contractor.
- B. Manufacturer to provide detailed installation instructions and directions for installation of embedded items, welded items, and through-bolted items, etc.
- C. Manufacturer to provide installation assistance during installation of the equipment. However, the responsibility of the installation rest with the general contractor unless equipment is installed and certified by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS & INSTALLERS

- A. Basis of Design Product: Subject to compliance with requirements, provide suspended access and fall restraint systems as manufactured by Summit Anchor Company or comparable product by one of the following:
 1. American Davit and Anchor
 2. Pro-Bel Enterprises, Ltd.

2.02 STRUCTURAL COMPONENTS' MATERIALS

A. Exposed Structural Components Finish: Galvanized Mild Steel or Stainless Steel

1. Steel: ASTM A572 GR 50
2. Steel: ASTM A A36
3. Galvanizing: ASTM A123
4. Stainless Steel; 304 ASTM A 193 Grade B8, Class 2
5. Aluminum; 6061-T6 Alloy

B. Yield Strength

1. Base Plates and Bottom Plates, High Strength Steel: 50 ksi minimum
2. Other Sections: 36 ksi minimum

C. Non-Structural Components

1. Aluminum; 6061-T6 Alloy
2. Alloys shall conform to requirements published in AA Aluminum Standards.
3. Sheet and Plate: ASTM B209
4. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221

D. Cold-Rolled Sections

1. ASTM A500
2. Yield Strength: 55 ksi minimum
3. Tensile Strength: 62 ksi minimum

E. Nuts, Bolts, Davit Pins, and Washers

1. Stainless Steel; 304 ASTM A 193 Grade B8 or F593C
2. Galvanized Flat Washers ASTM F-436 or 18 -8 Stainless Steel

F. Anchor Bolts (for securing base plate)

1. Metal: Stainless Steel, 304 Stainless Steel; ASTM A 193 Grade 8, B8
2. Size: 5/8 in. diameter minimum

2.03 MANUFACTURED UNITS

A. Anchor

1. Capable of withstanding 5000 lbs. (2268kg) in any direction without permanent deflection.
2. Anchor eye size: Not less than ¾ inch (20 mm) diameter material with 2 ¼ in (60 mm) eye opening.
3. Anchor eye metals:
 - a. Forged, 1030 quenched and tempered per ASTM 576-90-b, 72ksi minimum
 - b. Stainless steel, type 304, solution annealed, 35 ksi minimum
4. Anchor tube height: not less than 4 in. above the finished roof.

B. Davit Base

1. Stanchion type complete with davit adapter and lock pin with stainless steel safety snap pin.
 2. Davit socket; with two stainless steel hinge pins and stainless steel safety snap pins.
 3. Pier Height: not less than 10 in. above finished roof surface to allow proper fit up with adaptor.
- C. Cable system
1. Install complete with inline shock absorber to limit load to 2,250 lbs. or less at terminating anchors.
 2. Pass through cable anchors to allow up to two workers to traverse straight cable runs with single lanyard without detachment off lanyard.
- D. Flashing – verify compatibility with roofing system
1. Seamless Spun Aluminum Flashing: ASTM B221; Type 6061-T6 alloy
 2. Stainless Steel: 304

2.04 FABRICATION

- A. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to appearance and performance.
- B. Grind off surplus welding material to ensure exposed surfaces are smooth so as not to abrade workers' ropes.
- C. Welding shall be in accordance with the AWS Structural Welding Code D1.1/D1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions
1. Examine areas and conditions under which permanent window washing equipment shall be installed.
 2. Report to general contractor any conditions that deviate from shop drawings or any defects in workmanship that would cause an unsafe installation. This report shall be verified in writing to the general contractor and any other responsible party.
 3. Correct conditions detrimental to timely and proper execution of work.
 4. Do not proceed until unsatisfactory conditions have been corrected.
 5. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance by installer.
 6. Faults occurring in work of this section due to acceptance of unsatisfactory conditions shall be corrected at no additional cost to owner.

3.02 INSTALLATION

- A. General Requirements
1. Coordinate anchor installation with roofing installation to ensure a watertight and warrantable condition of the roofing. Anchors shall be directly flashed into roofing in a manner compatible with roofing system and anchors.

2. When components come into contact with dissimilar metals, surfaces shall be kept from direct contact to prevent corrosion.
3. No wall anchors shall be installed through membrane roofing system without specification detailing such from the architect or water proofing company warranting the roof.
4. Deform a minimum of two threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal or vandalism. Deform threads with 2/32" stainless steel punch

B. Instructions for welding access equipment to structure

1. All welders must be certified to American Welding Society (AWS) in accordance with AWS standards.
2. Welding rods used to weld the anchor system to be E70 xx electrodes.
3. Prior to welding anchors to structure, abrasively remove within one inch of all welded surfaces galvanizing, mill, scale, and rust.
4. Immediately after welding, chip away slag to prepare for welding inspector to inspect welds.
5. An AWS certified welding inspector must inspect and confirm size of all field welds. Following the inspection a written report must be supplied to the building owner and/or general contractor. Welded joints shall not be painted until after welding has been completed and the weld accepted.
6. Immediately after an acceptable inspection, paint welded areas with cold-galvanizing compound to protect from corrosion.
7. Structural steel to receive roof or wall anchors shall have a surface wide enough so that base plate can be welded all the way around. For example, anchors equipped with 4½ in. (112.5 mm) base plates would require a minimum 5 in. (137.5 mm) surface to weld to.

C. Aluminum Flashing

1. Deck flange shall be flashed in compliance with National Roofing Contractor Association recommendations.

3.03 REPAIR/RESTORATION

A. Galvanizing Touch-Up

1. Immediately after erection clean field welds and abraded areas. Repair damaged areas in compliance with ASTM A780.

3.04 FIELD QUALITY CONTROL

A. Inspection and site visits

1. Inspections and site visits shall be performed while installation of equipment is in progress under the supervision qualified professional engineer registered in the jurisdiction where the project is located.
2. On site inspection of equipment welded to structure shall be performed by an AWS Certified Welding Inspector verifying, in writing, size and quality of welds. Such an inspection shall be performed on each piece of equipment before roofing material is installed.
3. On site inspection shall be performed on all cast in place items while being tied in with the rebar with sufficient time before concrete is poured to allow to adjustments to embedded items as recommended by inspector.
4. G.C. shall be responsible to schedule above site visits and inspections with sufficient advanced notice given to the inspection company.

B. Site Tests

1. All equipment shall be tested on site in accordance with manufacturer's recommendations, under the supervision of a professional engineer, and ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standards, before being placed in service.
2. Equipment shall be tested under the supervision of a professional engineer with experience with suspended maintenance equipment and manufacturers guidelines.

C. Manufacturer shall assist and/or supervise installation of window washing equipment installed by others when such is included in contracted.

3.05 ADJUSTING

- A. Verify that completed work has been installed correctly and products function properly. Make adjustments where needed to ensure satisfactory operation.
- B. Complete inspection logbook to certify system for use noting any deviations, changes, or corrections from original shop drawings. Provide as-built anchor layout plan on 11 in. x 17 in. paper or larger together with annual inspection log book.

END OF SECTION 11 24 24

SECTION 12 87 20
STATION TRASH RECEPTACLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes:
1. Trash receptacles (new and relocated from station house).
 2. Trash receptacle liners.
 3. Material necessary for anchoring of trash receptacles to platforms and interior station concrete floors.

1.03 SUBMITTALS

- A. Samples: Submit samples of products with materials and finishes specified in this section for approval by the Authority.
- B. Product Data: Submit manufacturer's technical data, specifications and anchorage instructions for trash receptacles.
- C. Shop Drawings: Submit shop drawings for trash receptacles including plans, elevations, details of construction and detailing connections to different materials as applicable in each station. Show anchorage and accessory items.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in successfully producing fabrications similar to that indicated for this Project, with sufficient production capacity to produce the required number of units.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Trash receptacles and their accessories shall be delivered with proper protection to prevent damage during shipping and handling.
- B. Trash receptacles with their accessories shall be as a complete trash receptacle assembly for each trash receptacle.

PART 2 PRODUCTS

2.01 TRASH RECEPTACLES

- A. Trash receptacles shall be Ironsites Series Model No. SD-42, Color: White, with opening side door as manufactured by Victor Stanley, Inc. Brick House Road Dunkirk, MD 20754.
- B. Vertical bars shall be 3/8 inch by 1 inch steel bars curved outward at top. Three horizontal bands shall be 1/4 inch by 2-1/2 inch solid steel bars. At top edge, band shall be a 5/8 inch outside diameter steel rod. All joints and connections shall be fully welded. Bars shall be configured and spaced in accordance with the approved shop drawings.

Provide steel bars welded to the bars at the base with a 3/4 inch square anchor bolt hole at the center.

- C. Lids shall be Dome Top Model S-2, as manufactured by the same manufacturer of the trash receptacle. Receptacle lids shall be spun steel with a raised steel dome. Minimum steel thickness for the lid shall be 16 gauge. Lid shall be welded to receptacle at 5, 1 inch long locations, equally spaced around receptacle.
- D. Trash receptacles liner shall be Model NPL-36 high-density plastic liner with a 36 gallon capacity. Color shall be white.
- E. Finish: Unit shall be mechanically and chemically cleaned prior to the finishing process. All fabricated steel units shall be steel shot-blasted, etched, phosphatized and electrostatically powder-coated with TGIC or equal polyester powder coatings to a minimum thickness of 5 mils in accordance with manufacturer's recommendations. Color shall be white.
- F. Fabrication: Top ring and horizontal bands shall be rolled and welded into a continuous circle. The entire assembly shall be welded at every junction for unitized strength. Raised steel dome top shall be supported from inner ring with 3 vertical bars, all connections welded. Liner shall be accessible from a hinged section of the receptacle complete with stainless steel hinges, lock and 2 keys. Five leveling feet of 3/8 inch diameter threaded steel shaft, rubber-tipped, shall be factory installed.
- G. Fasteners: Trash receptacles shall be anchored to concrete using 1/2 inch diameter stainless steel expansion bolts and anchored to wood platform deck with 1/2 inch diameter lag screws.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Anchor trash receptacles to station concrete floor and platform wood or concrete deck at locations indicated in accordance with manufacturer's written instructions.

END OF SECTION 12 87 20

SECTION 13 06 00
CUSTOMER ASSISTANT'S SHELTER

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Stainless steel wall panels with stainless steel door frame and door, vision panels, attack resistant glazing door louver.
- B. Stainless steel counters with drawer cabinets.
- C. Finish hardware (doors).
- D. Suspended plastic egg crate ceiling.
- E. Sheet vinyl flooring and base.

1.03 RELATED SECTIONS

- A. Related Sections: The following sections contain requirements that relate to this Section:
1. Section 03 30 00 "Cast-In-Place Concrete".
 2. Section 08 80 00 "Glass and Glazing".
 5. Section 10 42 60 "Signage" station signage.
 6. Division 23 - Mechanical; Unit heater, and controls.
 7. Division 26 - Electrical: Electrical power, wiring, switches, light fixtures, and communications.

1.04 SUBMITTALS

- A. Shop Drawings: Include catalog cuts, design fabrication and erection drawings, finish specifications, and other data necessary to clearly describe design, materials, sizes, layouts, construction details, fasteners, hardware, insulation, glass, and erection. Submit small scale layouts of floor, wall, and roof panels, and large scale details of panel joints, edge conditions, door and window details, fasteners, hardware and sealant placement.
- B. Furnish wiring diagrams for all systems of the work.
- C. Product Data: Submit manufacturer's technical data for all equipment items.
- D. Samples: Comply with the General and Special Conditions and Division 1 requirements:
1. 6" x 6" sample of stainless steel.
 2. 12" x 12 wall panel assembly.
 3. 12" x 12" glass panel.
 4. 12 x 12" egg crate ceiling.
 5. 12" x 12" vinyl flooring.

1.05 QUALITY ASSURANCE

- A. Reference Standards: The work is subject to requirements of applicable portions of the

Underwriters' Laboratories. Provide electrical components that are U.L. labeled and listed. Comply with applicable requirements of Architectural Woodwork Institute. Provide qualifying welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

- B. Manufacturer shall have at least ten continuous years of experience in the manufacture of similar enclosures and be able to submit evidence of ability to comply with these specifications. No fabrication shall be started until name of manufacturer has been submitted by the contractor for approval of the Engineer.
- C. Manufacturer's plant shall be open to the Authority for its inspection. Complete fabrication methods and procedures shall be demonstrated to the Engineer upon request.
- D. Manufacturer shall demonstrate that manufacturer's plant is adequate enough to handle the fabrication and installation within the allotted construction period.
- E. Assemble Shelter in manufacturer's shop to the greatest extent possible to ensure that all parts fit and conform to the design intent. Disassemble only to the extent required for shipping.

1.06 DESIGN CRITERIA

- A. The walls, windows, doors, louver panels, and external components of Shelter shall have attack-resistant characteristics.
- B. Perform engineering of the Customer Assistant's Shelter based on the design, the materials, and the performance criteria specified. The Drawings for the work establish the design which consists of dimensions, alignment of components, member and component profiles and sight lines. Details indicated are not all inclusive. Provide additional details as may be necessary. Do not modify the design except as can be demonstrated to be absolutely necessary to meet specified performance requirements and to coordinate the work and then only with the approval of the Engineer.
 - 1. Preliminary drawings showing modifications to the design (if any) shall be submitted to the Commissioner for review, prior to award of contract.
 - 2. Structural Steel: For the design of structural steel members, comply with the requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
 - 3. Light Gauge Steel: For the design of light gauge steel members, comply with the requirements of the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gauge Steel Diaphragms" for design requirements and allowable stresses.
 - 4. For welded connections, comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.
- C. Structural Properties: The structure shall be designed to withstand the following Wind Load: Positive (inward) and negative (outward pressures of not less than 30 psf. Maximum deflection of any member, in a direction normal to the plane of the wall, shall be no more than L/240 of the clear span. Influence of glass on stiffness when it reduces deflection, shall not be considered. Comply with the requirements of the Chicago Building Code, latest edition.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Packaged materials shall be delivered to the project in sealed containers bearing

manufacturer's name and material identification. Materials shall be stored in strict accordance with the manufacturer's printed directions. Protect all stainless steel surfaces with pressure sensitive vinyl protective covering, which shall be removed after completion of installation.

- B. Protection: Protect materials against damage from mechanical abuse, plaster, salts, acids, staining, and other foreign matter by an approved means during transportation, storage, and erection, and until completion of construction work. All unsatisfactory materials shall be removed from the premises, and all damaged materials replaced with new materials at no additional cost to the Commissioner.

1.08 OPERATION AND MAINTENANCE MANUAL

- A. Submit operating instructions, maintenance schedules, and parts lists for all equipment in accordance with the Contract Documents.
- B. Operating and maintenance manuals shall be prepared by the manufacturer, with written instructions relative to the care, adjustments, and operation of all parts of the equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer shall have not less than 10 years continuous experience in the manufacture of enclosures of the same type as required for the Project and be able to submit evidence of ability to comply with requirements of the Specifications to the satisfaction of the Commissioner. Shelter fabrication shall not begin until such evidence has been submitted to and Manufacturer has been approved by the Commissioner.
 - 1. Chicago Bullet Proof Equipment Company
 - 2. National Bullet Proof Inc.
 - 3. Mosler, Inc.

2.02 MATERIALS

- A. Metals: Use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, roughness, "oil canning", discoloration or other imperfections.
- B. Steel framing of prefabricated components shall consist of ASTM A 36/A 36M steel.
- C. Steel Tubing: ASTM A 501.
- D. Stainless Steel: AISI Type 302/304, 18-8 Grade, No. 4 finish, vertically textured unless indicated on the drawings.
 - 1. Bar Stock: ASTM A 276.
 - 2. Plate: ASTM A 666.
 - 3. Tubing: ASTM A 269.
- E. Cold-Formed Steel Framing Members: Shapes as necessary for design and function, roll formed from steel complying with ASTM A 570/A 570M or A 653/A 653M.
- F. Galvanized Sheet Steel: ASTM A 653/A 653M (commercial quality), or lockforming quality, galvanized coating designation G 90, 0.90 oz./ft.2 zinc coating, mill phosphatized.

- G. Wall Panels: Fabricate framing and any required reinforcing from 3" x 8 gauge metal channel structural steel shapes welded. Fill voids with rigid insulation and face on both sides with 16 gage stainless steel sheets welded to the framing and ground smooth. Vertical edge of panels to be one piece formed with the outside face of stainless steel sheet. Inside sheet of stainless steel to be screw fastened. Stainless steel shall be #4 satin finish brushed in the vertical direction, or textured stainless steel, as shown. Stainless steel cladding to be continuous all sides. Provide 8 gauge corner reinforcement angles at exposed corners, as shown on drawings.
1. 16 gauge ribbed Stainless Steel where indicated in the drawings: Rigidized Metals "5-WL SS304 Satin".
- H. Wood: Each piece grade stamped with inspection agency stamp.
1. Plywood: PS-1 and thickness as shown.
 2. Flooring: APA Rated Sturd-I-Floor, Exposure 1, tongue and groove edges.
 3. Backing at Stainless Steel Counters: APA A-C exposure.
 4. All plywood shall be exterior grade, fire-retardant treated.
 5. Provide Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.
- I. Polystyrene Insulation For Panels: Insulation shall be built into Shelter's wall panels. Molded Polystyrene Plastic Board Insulation: Closed-cell, expanded polystyrene beads molded into rigid boards, complying with ASTM C 578, Type IX. Insulation shall provide a "R" factor of 4.76 @ 40 deg. F, and compressive strength of 25-33 psi.
1. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - a. Polyfoam Packers Corp.
 - b. AFM Corporation.
 - c. W. R. Grace.
- J. Doors and Frames: Doors and frames shall be constructed of stainless steel meeting the requirements specified under Design Criteria. Door frames to be 8 gauge stainless steel, No.4 satin finish, secured to stainless steel Shelter structural tube and wall panels. Door shall be 1-3/4 inch total thickness with internal horizontal stiffeners welded to No. 4 satin finish stainless steel face sheets and flush closer at top and bottom edges of door. Provide core insulation as noted for wall construction. Exterior side of door to be clad with textured stainless steel to window height. Door and frame shall be properly reinforced for mortise and surface mounted hardware. Provide cutout in door for vision panel. Glazing stops to be 8 gauge stainless steel and shall secure to interior side of door and be secured with fasteners spaced not over 8 inches on center. Door glazing to be 9/16" laminated attack resistant glass.
- K. Shelter Door Hardware:
1. Hinge: Provide heavy-duty stainless steel continuous hinge (plain finish) No. STS 311-1/4 or Commissioner-approved equivalent, of width required for door thickness. Use stainless steel tamperproof fasteners.
 2. Lockset: Corrosion resistant mortise lock and stainless steel face plate with 3/4" throw BHMA 630 finish manufactured by Best Lock Corporation 35H7EW16J Series, or equal lock of Corbin Russwin. Locking floor bolts shall also be provided. Locksets shall carry a manufacturer's five year warranty against

manufacturing defects and workmanship.

3. Strike: ANSI #A 115.1.
4. Cylinder: Best removable core cylinder with construction core #1 E74 US32D cylinder. Provide construction core and control key from local office. Contractor shall provide uncombined cylinder and removable core to the Commissioner for combining and installation.
5. Keying: Customer Assistant's And Concession Shelter - Best system keyed independently.
6. Closer: LCN (4110 series) with 90 degree stop.
7. Weatherstripping: Zero #328A all around.
8. Metal Threshold with Weatherstripping: 4-inch wide, aluminum, #544A "Zero" or approved equal; set in mastic and secured to floor.
9. Fasteners: All exposed screw heads shall be tamperproof flat head type, in stainless steel.
 - a. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.
 - b. Wood screws: Cadmium plated steel, FS-FF-S-111.
 - c. Toggle Bolts: Tumble wing type, FS-FF-B-588.
 - d. Plain washers: Round, carbon steel, FS-FF-W-92.
 - e. Lock Washers: Helical spring type carbon steel, FS-FF-W-84.
10. Locking floor bolt: Adams Rite Series MS1861, bottom rail dead bolt with compatible dustproof strike.
11. Door Monitor Switch: Concealed design for use with steel doors. Concealed magnetic contact with both switch and magnet isolated from surrounding steel. Rhodium plated contacts to prevent sticking and cold welding. 3/4" diameter magnetic contact rated for 7/8" maximum gap.

L. Vision Panels:

1. Stationary Windows: Glazing stops shall be 8 gauge stainless steel. Stops shall be secured to interior of modular enclosure panels. Provide performed wedge strips or compression gaskets, black neoprene ASTM C 509, Type II, closed cell extruded or molded and silicone sealant glazing.
2. Fixed Windows: Frames shall be stainless steel and designed for installation in modular enclosure panels. Vision panels shall be manufactured so as to be able to slide open. Vision panel shall be lockable from the inside.
3. Glazing stops to be mitered at corners.
4. Glazing: provide Attack Resistant "Secur-Tem + Poly" glass-clad polycarbonate laminate manufactured by Globe Amerada Glass (or other approved manufacturer) with the following characteristics:
 - a. 9/16 inch (.5625 inch) overall thickness consisting of:
 - 1) 1/8 inch thick Chem-Tem, chemically strengthened glass.
 - 2) 0.050 inch Urethane.
 - 3) 1/4 inch polycarbonate.
 - 4) 1/8 inch thick Chem-Tem, chemically strengthened glass.
 - b. Weatherability Tests: Meets ANSI Z.26.1-1977 and Z.26.1a-1983 and ASTM E773 and E774.
 - c. Clear Light Transmittance: 76 percent visible.
 - d. Attack Resistance: Tested by H.P. White Laboratories. Meets Level I Forced Entry.
 - e. Ballistic Protection: 0.38 Special Handgun; 3 shots in an 8 inch circle, 158 grain lead, 20 feet.
 - f. Results: Spall; no penetration.

5. Provide single responsibility for all phases of manufacturing, from the chemical strengthening of the raw glass through the final lamination.

M. Vinyl Flooring.

N. Counters, Drawers and Cabinets:

1. Countertop, cabinets, doors, shelves, and drawer cladding (all surfaces inside and outside) shall be 16 gage stainless steel #4 satin finish with brush marks in the vertical direction. Provide 3/4" plywood for all components of cabinet assembly.
2. Counter support shall be 1/8" steel bracket assemblies to adequately support counter. Anchor to wall panels, reinforce wall panels internally at brackets. Brackets shall be at 3'-0" o.c. and at all end conditions.
3. Hardware: Provide cabinet hardware and accessories associated with architectural cabinets. All casework hardware shall be stainless steel, US32D.
 - a. Piano hinges-concealed.
 - b. Cylinder lock keyed for "Best" ZB-6 keys.
 - c. Drawer Slides - ball bearing with 70 lbs. capacity.
 - d. Pulls - continuous edge molding.
 - e. Catches - magnetic.
 - f. Standards and clips.

O. Ceiling:

1. Basis of Design:
 - a. Railtech Composites, Inc. "Lamcel Ceilings" stainless steel faced honeycomb core ceiling panels with Panel-Lok concealed suspension system. Steel facing shall be continuous at all edges to form a closed panel.
 - 1) Finish: No. 4, non-directional satin polished.

- b. Suspended framing and accessories as specified in Section 09111, Non Load-Bearing Steel Framing.

2.03 FABRICATION, GENERAL

- A. Customer Assistant Shelter shall be custom fabricated as detailed and shall be complete with fixtures and accessories shown, installed in place and in proper working order. Final connections to services are specified in the electrical and mechanical work.
- B. Fitting and assembly of the work shall be done in the shop. Work that cannot be permanently shop assembled shall be completely assembled, marked and disassembled before shipment to ensure proper assembly in the field.
- C. The metal interior and exterior for the Shelter shall be electrically continuous and provision made for connecting to equipment ground system at station.
- D. Use only proven methods that produce the workmanship specified for the work. Methods of assembly and joining which will affect the appearance of the work shall be subject to the acceptance of the Authority.
- E. All exposed work shall be carefully matched to produce continuity of line and design. All joints in exposed metal work shall be accurately fitted and rigidly secured.
- F. Form metalwork to required shapes and sizes, with true curves, lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible.
- G. Fabricate and fasten metalwork so that the work will not be distorted nor the fasteners overstressed from the expansion and contraction of the metal.
- H. All welding shall be in accordance with the American Welding Society for recommended practices in shop welding using electrodes specified by the manufacturer of the alloys being welded. Provide welds behind finished surfaces without distortion or discoloration of the exposed side. All weld beads on exposed surfaces shall be ground and finished to match and blend with finish on adjacent parent metal. Grinding and polishing shall be done only with clean wheels and compounds free from iron and iron compounds.
- I. Mill edge joints to well-defined lines. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- J. After grinding, polishing or forming metal surfaces, clean surfaces with a detergent solution (containing no chlorides to remove all extraneous materials, rinse thoroughly with clear water and dry.

2.04 WALL AND DOOR FABRICATION

- A. Fabricate stainless steel walls and doors to be rigid, neat in appearance and free from defects warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously; grind, dress, and make smooth, flush and invisible.
- B. Exposed Fasteners: Do not use exposed fasteners except where unavoidable. Exposed fasteners shall be countersunk flat Phillips or Jackson heads for exposed screws and bolts.
- C. Prepare doors and frames to receive concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with templates provided by hardware manufacturer.

- D. Fabricate stainless steel wall panels and doors of two (2) stainless steel sheets not less than 16 gauge. Weld stainless steel sheet to stainless steel 16 gauge channels at perimeters. Vertical edge of panels may be one piece formed with the outside face of stainless steel sheet. Inside sheet of stainless steel shall be screw fastened. Construct with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges. Provide corner reinforcement angles at exterior corners.
- E. Door Frames: Fabricate door frames of 14 gauge stainless steel. Provide full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width. Provide anchors to wall panel construction.
- F. Stops: Form fixed stops and moldings integral with frame. Provide removable stainless steel stops. Secure with countersunk machine screws spaced uniformly not more than 12" on center. Form corners with mitered hairline joints.

2.05 SHELTER FABRICATION

- A. Fabricate Shelter to sizes and details as shown on approved shop drawings. Verify all dimensions and installation conditions in field.
- B. Stainless steel halo to be 3" x 3" x 1/4" stainless steel tube with mitered corners, welded and ground flush and smooth. Provide stainless steel support tubes and columns.
- C. Top of Shelter to be formed of 3" x 10" x 1/4" stainless steel tube with mitered corners, welded and ground flush and smooth. Clad with 16 gauge textured stainless steel panels.
- D. Tube assembly at top of Shelter to support roof deck. Cut roof deck to fit. Roof decking to span Shelter. Cover top of deck with stainless steel diamond plate with 1" return at all sides. Secure plate to decking with stainless steel screws with neoprene washers.
- E. Vertical column supports for Shelter to be 3" x 3" x 1/4" steel tube clad at exterior and interior with stainless steel.
- F. Stainless steel wall fabricated panels to be secured to vertical columns with bolts at 12" on center and to station house subfloor with bolts at metal tab welded to panel frame (3 per panel). Provide 8 gauge corner reinforcement angles at outside corners. Provide continuous stainless steel cover (textured or smooth) both sides.
- G. Secure window and vision panels to top tube frame, vertical tube frame, and wall panels with 8 gauge stainless steel stops secured to tubes and wall panel frames. Miter glazing stops at corners. Miter corners of glass and fill gap with clear sealant at outside corners. Door frames to be secured to wall panel frames.
- H. Provide separation between dissimilar metals where required.

PART 3 EXECUTION

3.01 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of the work. Do not delay job progress. Allow for adjustments and fitting where taking of field measurements before fabrication might delay the work.
- B. Coordinate anchor plate installation and setting drawings, diagrams, templates, instructions and directions for installation and anchorage to concrete slab.

3.02 INSPECTION

- A. Inspection of Structure: Before components are delivered to the site, examine the Shelter's final location and report in writing to the Engineer, any conditions which in the installer's opinion will prevent the proper execution of the work or endanger its permanency. The erection shall not proceed until such conditions are corrected or adjusted satisfactorily.

3.03 INSTALLATION

- A. Set prefabricated Shelter, or assemble Shelter components accurately in location, alignment, and elevation. Set work plumb, level, true and free of rack.
- B. Fit exposed field connections accurately together to form tight hairline joints unless otherwise shown.
- C. Limit field welding to those connections which will be concealed in the finished work. Comply with AWS code for procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welded work.
- D. Install components without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to doors and drawers to provide unencumbered operation.
- E. Restore protective cover if damaged during shipping and installation. Remove protective cover when there is no possibility of further damage from construction activities. Remove protective cover from Shelter all at one time to prevent uneven discoloration.
- F. Coordinate the installation of mechanical work as required and specified in Division 15.
- G. Coordinate the installation of electrical and communication work as required and specified in Division 16.
- H. Electrical Conduit and Junction Boxes: Provide electrical conduits and junction boxes concealed in Shelter walls. Materials and installation shall comply with requirements of Section 16050, "Basic Electrical Materials and Methods".

3.04 ADJUSTING AND TESTING

- A. Adjust all operating parts such as doors and drawers for proper and free operation.
- B. Coordinate the testing of all systems which are controlled from the Shelter in cooperation with installing contractors of the various systems and in the presence of the Commissioner.

3.05 PROTECTION AND CLEANING

- A. Protect all materials against damage from mechanical abuse, plaster, salts, acids, staining or other dirt during erection and until completion of construction work. All unsatisfactory materials shall be removed from the premises, and all damaged materials replaced.
- B. After substantial completion, clean down all exposed surfaces, including glass.

END OF SECTION 13 06 00

SECTION 14 21 00
ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.01 SUMMARY

- A. This Section includes all labor, materials and equipment required to provide and install the electric traction passenger elevator system as shown on the drawings, specified herein, and as otherwise required for a complete functional installation.
1. Elevator system for this project includes a Heavy-Duty Traction Elevator.
- B. Elevator schedules at the end of this section indicate required performances, controls, capacities, dimensions, features and finishes for each elevator required for this project.
- C. Provide Oculus Monitoring System to monitor elevator.
- D. Coordinate elevator installation with all related trades responsible for the work at the station and platform in order to maintain the schedule and to ensure the orderly sequence of the work. Provide sleeves, inserts, and anchoring devices in a timely fashion to maintain the construction schedule as required for installation under the Contract. Coordinate locations of conduits in hoistway with electrical contractor. Coordinate installation of the traction elevators with the hoistway shaft construction and machine room construction.
- E. Work that must be supplied under other sections include temporary lighting for hoistway, guide rail support, lifeline attachments, pit lighting, control space lighting, access doors, and other work as required for a complete operational system.
- F. It is the Contractor's responsibility to coordinate the structural design of the hoistway and coordinate the electrical and other requirements with the elevator manufacturer for the particular elevator to be used.

1.02 RELATED WORK

- A. Related Sections
1. Sections 03 30 00 – Cast-in-place Concrete.
 2. Sections 05 10 30 – Structural Steel
 3. Section 05 50 00 – Metal Fabrications
 4. Section 05 70 00 – Decorative Metal Panels
 5. Section 08 80 00 – Glass and Glazing.
 6. Division 22 Sections, Mechanical.
 7. Division 26 Sections, Electrical.

1.03 REFERENCES

- A. AISI: American Iron and Steel Institute.
- B. ANSI A117.1, Accessible and Usable Buildings and Facilities.
- C. ASME/ANSI A17.1, A17.2.3, A17.5; 1996 edition; Safety Code for Elevators and Escalators.
- D. ASME/ANSI A17.3, Safety Code for Existing Elevators and Escalators.
- E. ASTM A36/A36M: Standard Specification for Carbon Structural Steel.
- F. ASTM B151: Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar.
- G. AWS: American Welding Society.
- H. Chicago Building Code.
- I. FCC: Federal Communications Commission
- J. IEEE: Institute of Electrical and Electronic Engineers standards.
- K. NEMA: National Electrical Manufacturer's Association.
- L. NFPA 70: National Electrical Code (NEC).
- M. NFPA 80: Standard for Fire Doors, Fire Windows.
- N. Americans with Disabilities Act (ADA), Accessibility
- O. Guidelines for Buildings and Facilities (ADAAG).

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature for each principal component or product of each elevator, including certified test reports on required testing. Indicate capacities, dimensions, design, layout, finishes, accessories, available options, and similar information. Provide information on performance and operating characteristics, features of control system, signals, and operating system. Indicate any variations from specified requirements.
- B. Shop Drawings including dimensioned drawings for each elevator showing plans, elevations, sections and large-scale details indicating service at each landing, clearances, coordination with building structure and relationships with other construction, and details of car enclosures and hoistway entrances. Indicate required hoistway and pit dimensions, showing guide rails, buffers, and other components in hoistway. Indicate maximum rail bracket spacing. Include elevator diagrams to indicate elevator service to each level. Provide shop drawings showing location and layout of all elevator equipment, signals, control panels, call stations, indicator lights, graphics, and similar items. Indicate any variations from specified requirements plus maximum dynamic and static loads imposed on building structure at points of support. Indicate hoist beam requirements. Indicate access and ventilation for elevator machinery rooms and hoistways; indicate location, sizes, and details of access doors and hoistway door and frames.
- C. Wiring diagram detailing locations and wiring for power, signal, communications, and

control systems and differentiating clearly between manufacturer-installed wiring and field-installed wiring. Indicate maximum and average power demands; electrical characteristics and connection requirements.

1. Provide electrical characteristics and connection requirements.
 2. Provide the expected heat dissipation of elevator equipment space and controller space BTU based on maximum possible full load starts per hour.
- D. Samples of exposed finishes of car enclosures, hoistway entrances, and signal equipment. Provide 6 inch to 8 inch square samples of sheet materials and 10 inch to 12 inch lengths of running trim members. Submit color samples of car floor finish material for selection by the Authority. Provide samples, as requested by the Authority, of other elevator components including, but not exclusive of, call buttons, indicator lights, glazing, etc.
- E. Maintenance Manuals: Submit, for review, two (2) bound manuals for each station, for each elevator or group of elevators, with operating and maintenance instructions, parts listing, recommended parts inventory listing, purchase source listing for major and critical components, emergency instructions, and similar information. Include all diagnostic, maintenance and repair information available to manufacturer's and installer's maintenance personnel. Include a maintenance and lubrication schedule and directions. Include a copy of the elevator warranty, and maintenance schedule.
- F. Certificates and Permits: Provide the Authority with copies of all inspection/acceptance certificates and operating permits as required by governing authorities to allow normal, unrestricted use of elevators. One permanent frame for the certificate or operating permit shall be mounted in the car (or alternate location in the Customer Assistant Shelter as approved by the City of Chicago) and a duplicate shall be provided in the cab frame.
- G. Wiring Schematics: Submit wiring schematics and interconnections for the elevator control and drive system. Also, submit intercom/ communication system connection and controls.
- H. Provide hoist beam requirements and maximum loads imposed on building structure.
- I. Documentation certifying the experience requirements of the manufacturer, certifying the experience of the installer, and a list of completed projects.
- J. Upon completion, as-built drawings are to be submitted including schematic control wiring and electrical wiring diagrams and electronic and hard copies of ladder diagrams, logic and program.

1.05 DEFINITIONS

- A. Traction Elevators: Elevators in which cars are hoisted either directly or indirectly by ropes or cables over power-driven traction sheaves, complete with components, equipment, machines, controls, and devices as indicated and as required for safely operating elevators at rated speed and capacity including car enclosures, hoistway entrances, operation systems, signal equipment, guide rails, electrical wiring, roping or cables, buffers, and devices for operations, and for complete elevator installation.
- B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.06 PROJECT AND SITE CONDITIONS

- A. Elevators shall not be used for construction purposes or Contractors use of transporting materials or equipment during construction.

1.07 DESIGN CRITERIA

- A. Provide elevators designed for heavy duty transit system usage, capable of being in operation 24 hours per day, 7 days per week.
- B. Exterior Installation: Provide units designed to operate while exposed to natural elements such as sunlight, rain, snow, slush, ice, dust, all conditions of relative humidity while exposed to salt, de-icing chemicals, and other corrosive elements and temperatures ranging from -25 degrees to +125 degrees Fahrenheit.
 - 1. Push button operation within the cab shall operate fully within this temperature range.
 - 2. The vertical travel distance of the cab shall be uninterrupted within this temperature range.
- C. Elevator systems shall be designed with provisions for thermal expansion and contraction of the complete assembly.

1.08 SYSTEM PERFORMANCE REQUIREMENTS

- A. The elevator schedules indicates required performances, controls, capacities, and electrical requirements for each elevator or group of elevator systems.
- B. Car Performance:
 - 1. Car speed plus or minus 5% of contract speed under any loading condition or direction of travel.
 - 2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.
- C. System Performance:
 - 1. Vertical Vibration (maximum): 15-17 mg.
 - 2. Horizontal Vibration (maximum): 10-12 mg.
 - 3. Jerk Rate (maximum): 3.3 – 5.25 ft/sec².
 - 4. Acceleration (maximum) 1.6 – 2.6 ft/sec².
 - 5. In Car Noise: = 55 dB(A).
 - 6. Leveling Accuracy: plus or minus 3 mm.
 - 7. Starts per hour (maximum): 240.

1.09 QUALITY ASSURANCE

- A. Manufacturer: Minimum of ten (10) years experience in the fabrication, installation and service of elevators of the type and performance specified. The manufacturer shall have a documented quality assurance program.
- B. Installer Qualifications: Engage the elevator manufacturer or an Installer approved by the elevator manufacturer and who has completed the elevator installations similar in material, design, and extent to that indicated for this Project and with a minimum of ten (10) years experience installing elevators and has a record of successful in-service performance. Documentation shall be submitted to support this requirement.
- C. Regulatory Requirements: In addition to local governing codes and regulations, test and comply with applicable requirements of the following:

1. ASME/ANSI A17.1, Safety Code for Elevators and Escalators (hereafter referred to as the "Code")
 - a. Seismic Risk Zone: Project is located in Zone O.
2. National Electrical Code.
3. Institute of Electrical and Electronic Engineers (IEEE) standards.
4. National Fire Protection Association (NFPA 70, 80)
5. American National Standards Institute "American National Standard for building and facilities – providing Accessibility and Usability for Physically Handicapped People" ANSI A 117.1 and the ADA Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.10 ELEVATORS to the exclusion that they do not conflict with each other.
6. Chicago Building Code: Conform to all applicable codes for manufacture and installation of elevator system.
7. Provide and pay for all tests and permits.

1.10 DELIVERY, STORAGE AND HANDLING

- A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the Contractor is responsible to store the equipment in a secure, dry, protected, and easily accessible storage area.

1.11 WARRANTY

- A. Warranties: Provide warranty, signed by the Contractor, elevator installer, and elevator manufacturer; guaranteeing to correct failures in the elevator system; replace, repair, or restore defective components, materials and workmanship of elevator work or equipment which occur during the warranty period.
 1. Warranty period shall be for twelve (12) months starting on the date of Final Acceptance for the project.
- B. The elevator warranty shall not deprive the Authority of other rights the Authority may have under other provisions of the Contract Documents and shall be in addition to other warranties made by the Contractor under requirements of the Contract Documents.
- C. Submit a copy of the warranty for the Authority's review, as required in the Submittals section above.
- D. A warranty inspection shall be performed, as required below.

1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide full maintenance service by skilled, competent employees of the elevator Installer for period of twelve (12) months following date of Final Acceptance of Project. Include monthly preventive maintenance, performed during normal working hours, for repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation in conformance with specified requirements. Copy of monthly inspection and maintenance reports are to be sent to the Authority's Elevator Department. Use parts and supplies as used in the manufacture and installation of original equipment. Perform maintenance, including emergency callback service, during normal working hours. Include 24-hour-per-day, 7-day-per week emergency callback service. Response time shall be two (2) hours or less for normal callback service and one (1) hour or less for emergency callback service. Exclude only repair or replacement due to misuse, abuse, accidents, or neglect caused by persons other than Installer's personnel.

PART 2 PRODUCTS

2.01 HEAVY DUTY TRACTION TYPE ELEVATOR SYSTEM

- A. Provide traction elevator system subject to compliance with the design and performance requirements of this specification.

2.02 MANUFACTURERS

- A. Manufacturers that may produce and install elevator systems specified herein include, but are not limited to, the following:
1. Mid-American Elevator Co, Inc
 2. Or approved equal.

2.03 MATERIALS AND COMPONENTS

- A. General: Provide manufacturer's elevator systems that comply with or fulfill the requirements of the elevator schedule or, at manufacturer's option, provide custom-manufactured elevator systems that will fulfill requirements. Where components are not otherwise indicated, provide standard components published by manufacturer as required for a complete system. All unpainted, unfinished non-wearing surfaces of elevator and equipment, exterior cab and hoistway, shall be painted three coats alkyd enamel (prime and 2 finish coats) manufacturer's standard color as selected by the Authority.
- B. All equipment and controls shall be of industrial quality and operate under indicated weather conditions and temperature extremes.
- C. Elevator Machines and Equipment:
1. Except as otherwise indicated, provide manufacturer's AC geared traction machine, especially designed and manufactured for this service. It shall include driving motor, alternating current electro-mechanical brake, and traction sheave, all mounted on a base or bed plate with sound isolation pads. The traction sheave shall be of heavy alloy iron, accurately turned and grooved for the hoist ropes.
 - a. The hoisting motor shall be especially designed for elevator service, reversible alternating current type developing high starting torque,

operated through Variable Voltage Variable Frequency drive with low starting current and shall be of horsepower for the duty specified. Motor speed shall not exceed 1800 RPM.

2. Power Control: Except as otherwise indicated, provide Solid State Control for the power control system (variable voltage and regenerative) in lieu of motor generator system.
 - a. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system from solid-state converters.
3. The alternating current motor shall have a permanent magnet tachometer generator mounted thereon and suitably coupled. Motors shall be reversible asynchronous or synchronous type of a design capable of developing the torque required to meet or exceed an acceleration rate of 2 ft/sec² for the elevator car. A means to protect the windings and bearings from airborne dust shall be provided.
4. Insulation of all windings shall be impregnated and baked to prevent absorption of moisture and oil. The insulation resistance between motor frame and windings shall not be less than one megohm. The motor windings shall stand a dielectric test of twice the normal voltage plus 1000 RMS volts of 60 Hertz, alternating current for one minute. The windings shall have a minimum insulation temperature rating two ratings higher than the actual temperature rise of the motor, with a minimum rating of NEMA class F.
5. Motor leads in the conduit box shall have the same insulation class as the windings. Motor lead wire shall be rated 125 C and shall be sized for 105 C at the motor nameplate amperes at 1.0 power Factor per Electrical Apparatus Service Association (EASA) recommendations. Leads are to be numbered for clockwise rotation when facing opposite the shaft end.
6. The motor shall be designed to the ASME A17.1 rated load requirements.
7. Control of the traction machine motor shall be by means of armature current thyristors and field current thyristors controlled to provide for regeneration during deceleration of the elevator. During any operation of the elevator with over hauling load (empty cab up or loaded cab down), precision speed control shall be obtained by regeneration of electrical power returned to the building electrical system.
8. Inserts: Furnish required concrete inserts and similar anchorage devices for the installation of guide rails, machinery, and other components of elevator work where installation of devices is indicated as work of another specification section or Contract.
9. Cab Frame and Platform: Frame and platform shall be manufacturer's standard welded steel units.
10. Sheaves and Beams: Deflecting sheaves shall be of heavy alloy iron, accurately grooved to fit ropes, of suitable size according to conditions, and fitted with heavy steel shaft, accurately machined of semi-steel of hardness BHN 220-250. The sheaves shall be supported by machine beams furnished and set in place by the Elevator Contractor.
11. Buffers: Substantial oil buffers shall be installed under the cab and counterweight. Buffers in the pit shall be mounted on continuous channels which are fastened to the guide rails.
12. Brakes: The brake(s) shall be of the self adjusting fail-safe (spring actuated, direct current and electrically released) type provided with an external manual brake release and of heavy duty construction with proper braking area for the load and speed specified. The brake shall be provided with sufficient power to stop and hold the car with full contract load. Disc or drum brake shall be securely mounted to the shaft and shall run concentric to the shaft. Disc or drum shall be machined to obtain a smooth and accurate face. Drum brakes shall have two (2)

- shoes actuated by two separate compression springs. Disc brakes shall be of caliper or multiple disc design.
13. Ropes: Furnish and install suitable traction steel wire hoist ropes of size and number to insure proper wearing qualities. As a minimum, the number of ropes shall comply with the factor of safety requirements of the ANSI Code. Governor ropes shall be of iron or steel. All ropes shall consist of at least six strands of wire wound about a core center.
 14. Electric Wiring: Furnish and install complete necessary insulated wiring to connect all parts of the equipment in conformance with NEMA 12 requirements.
 - a. Insulated wiring shall have flame retarding and moisture resisting outer cover and shall be run in metal conduit, metallic tubing or wire duct.
 - b. Traveling cables between cab and hoistway way shall have flame retarding and moisture resisting outer cover. They shall be flexible and shall be suitably suspended to relieve strains in the individual conductor cables shall be designed and manufactured specifically for repetitive movement and flexing in elevator hoistway.
 - c. All insulated conduction and conduit or tubing as well as fittings, including metal boxes, troughs and ducts, shall comply with the requirements of the National Electric Code and applicable local codes.
 - d. Conduit shall be connected to junction boxes and devices such that moisture is not collected in junction box or device.
 - e. Connect motors and other components subject to movement or vibration, to the conduit systems with flexible conduit.
 - f. Provide all necessary conduit and wiring between machine room area and hoistway.
 - g. Junction boxes in hoistway and on car shall be equipped with terminal blocks.
 - h. Cables shall be free from any possible contact with hoistway structure, car or other equipment. Furnish and install shields or pads to protect the cables.
 15. Guide Rails and Fastenings: Planed steel tees shall be provided as guides for cab and counterweight. These tees shall be erected plumb within 1/8 inch and fastened securely to the hoistway way framing by heavy steel brackets. They shall be properly located and supported so as to become distorted by eccentric loading. The guide rails shall be connected to steel splice plates. The rail contact surfaces of these plates and the backs of the guide rail ends shall be accurately machined to form smooth joints. The ends of all guides shall be tongued and grooved to provide matched joints. Guide rails for the cab and counterweight shall have sections and properties of which comply with the requirements of the ANSI Code. They shall be suitably bottomed in the pit and shall extend the full height of the hoistway. All connections and fastenings to structure shall be isolated from earth ground by neoprene pads and sleeves.
 16. Counterweights, Safeties and Counterweight Guards: Counterweights and safeties shall be located in the hoistway of the elevator which they serve or in a separate counterweight hoistway, subject to the limitations and requirements of Rule 103.3 of ANSI/ASME A17.1c-1986.
 - a. Counterweight Guards: Unperforated metal guards shall be installed in the pit located underneath the hoistway on all open sides of the counterweight runway.
 - b. Guards shall extend from a point not more than 12 inches above the pit floor to a point not less than 7 feet nor more than 8 feet above such floor, and shall be fastened to a metal frame properly reinforced and braced to be at least equal in strength and stiffness to 0.0747 inch sheet metal.
 - c. For guidelines governing separate counterweight hoistway ways

reference Rule 103.3 of the ANSI/ASME A17.1a.

17. Roller guides shall be equipped with quiet, rubber tired ball bearing rollers of ample diameter to run on dry unlubricated guide rails and each roller of respective guide shall be maintained in uniform contact with rail surfaces. The cab shall be properly balanced.
 18. Bearings: Bearings shall be rated for an AFBMA L10 life of 65,000 hours, under fluctuating bearing load. All bearings shall have basic dynamic load ratings.
- D. Elevator Drive System:
1. Non-Regenerative Variable Voltage Variable Frequency Drive. The drive shall be microprocessor and IGBT based using vector control algorithms. The algorithms shall incorporate a motor model to determine the electromagnetic state of the motor. The motor model shall also encompass a temperature compensation algorithm for speed accuracy.
 2. Velocity shall be controlled by a feedback loop to within plus or minus 2% of contract speed.
 3. Floor locations shall be stored in non-volatile memory and not be affected by a loss of power. Stopping accuracy shall be plus or minus 5 mm or less; re-leveling shall be automatic.
 4. Resistors shall be provided to absorb the power regenerated by the motor. They shall dissipate power only when the motor is regenerating. Control shall be by IGBT.
 5. Maximum total harmonic distortion shall not exceed IEEE Std. 519 to be measured at the elevator disconnect.
- E. Inserts: Furnish required concrete inserts and similar anchorage devices for the installation of guide rails, machinery, and other components of elevator work where installation of devices is indicated as work of another specification section or contract.
- F. Hanger Support: The hanger support shall be formed steel to provide for the operating equipment.
- G. Fascia Plates: Galvanized steel fascia plates shall be provided as required by Code, extending full opening width, from the sill of one opening to the hanger support below.
- H. Toe Guards and Dust Covers: Galvanized steel toe guards and dust covers shall be provided as required extending from sill or hanger to the wall to form a gradual slope.
- I. Fasteners:
1. Fasteners shall be compatible with materials being fastened.
 2. Fasteners shall be furnished with self locking nuts or retaining rings (spring washers, toothed disks).
 3. Fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistant metals being fastened.

2.04 CONTROL SYSTEMS

- A. An Allen Bradley ControlLogix, CompactLogix, MicroLogix, or approved equal PLC controller that supports DF1 communication over Ethernet /TCP/IP shall be designed to accomplish the type of elevator operation as indicated herein. Controller shall govern starting, stopping and direction of travel of the elevator.
- B. Controller shall protect the motor against current overload, phase reversal, and phase failure. A reverse phase relay shall be provided on the controller. Controller shall

automatically open the power supply, and bring the car to rest if any of the safety devices fail to operate or if the power fails.

- C. Selective Collective Operation: As defined by ASME A17.1 and shall be the pressure upon one or more car buttons shall send the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed, provided the hoistway door interlock and car door switch circuits are completed. During this operation, the car shall also answer calls from the landings, which are in the prevailing direction of travel. Each landing call shall be canceled when answered
1. Operation shall be automatic by means of the car and landing buttons. Stops registered by the momentary actuation of the car or landing buttons shall be made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. All stops shall be subject to the respective car or landing button being actuated sufficiently in advance of the arrival of the car at that landing to enable the stop to be made. The first car or landing button actuated shall establish the direction of travel for an idle car.
 2. UP" landing calls shall be answered while the car is traveling in the up direction and "DOWN" landing calls shall be answered while the car is traveling down. The car shall reverse after the uppermost or lowermost car or landing calls has been answered, and proceed to answer car calls and landing calls registered in the opposite direction of travel
 3. If the car without registered car calls arrives at a floor where both up and down hall calls are registered, it shall initially respond to the hall call in the direction that the car was traveling. If no car call or hall call is registered for further travel in that direction, the car shall close its doors and immediately reopen them in response to the hall call in the opposite direction. Direction lanterns, if provided, shall indicate the changed direction when the doors reopen.
- D. Controller shall be provided with starting switches of adequate size, together with all relays and switches to accomplish the type of elevator operation indicated herein. Switches that operate power circuits shall be designed to prevent sticking due to fusing. Overload relay shall be of the manual reset type of suitable size for the motor furnished.
- E. All controller components shall be neatly mounted and wired in a vented NEMA 4X stainless steel enclosure. All terminals and wires shall have identification markings. When venting of NEMA 4X cabinet cannot be achieved, all controller cabinets shall be supplied with a NEMA 4X compact cabinet cooler sized in accordance with manufacturers anticipated controller heat dissipation as supplied by Noren Products (www.norenproducts.com) and or approved equal. For wall mounted enclosures, these types of controllers are to be affixed to walls utilizing unistrut of sufficient strength and size capable of sustaining overall controller enclosure with components weight. For controller enclosures that are floor mounted and freestanding, these types of enclosures are to be supplied with a 6" high base to prevent potential water infiltration.
- F. Provide a separate battery powered unit that senses loss of power. Two (2) Batteries shall be 12 volt minimum, sealed nickel cadmium or gel cell construction. When loss of power occurs, elevator shall ascend or descend to nearest landing and open doors automatically. After a predetermined time, the doors shall close and the elevator shall remain inoperative until normal power is restored. The door open and alarm button shall operate under battery power. Reduced speed for evacuation on battery operation is permitted.
- G. The PLC shall communicate directly with the CTA OCULUS NETWORK® via serial connection to a new RTU interface panel through SCADA protocols. See Section 2.10 for additional information.

- H. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controller system.
- I. A BNC connector (stud/pass thru) shall be mounted in the controller and shall be used for the CCTV coaxial cable. Terminal blocks for CCTV power cables shall also be mounted in the controller. These connections shall be kept away from high voltage. Additional noise suppression devices may be required to filter video signal. BNC connector (stud/pass thru) will act as a junction for the video coax cable. Additional coax cable will be needed for the connection between the OMK and controller. Refer to drawings for indicated distances and proper cables to use.
- J. Car Stall Protective Circuit: Provide a protective circuit which shall stop the motor and return the car to its first floor landing in the event that the car, while traveling up, does not reach its designated landing within a predetermined time interval. This circuit shall permit a normal exit from the car but prevent further operation of the elevator until the problem has been corrected.
- K. PLC will be used for future remote monitoring capabilities. The installer's engineering department will be responsible for programming the PLC.
- L. The PLC rack shall provide space for the following Signal List and for two (2) future single slot modules.
- M. The PLC shall store the last 99 faults, accessible via laptop connection, panel view and remote communications.
- N. OEM's may not supply their standard elevator controller for this project unless conforming to the requirements of this section in its entirety.
- O. An alpha numeric fault indicator shall be provided in the service cabinet.
- P. In cases where the programming is done by the supplier, the supplier shall provide a copy of all working programs in electronic format as well as a printed program listing.
- Q. Each I/O shall be fuse protected or utilize optical isolation.
- R. Provide UPS for PLC memory.
- S. The ability to monitor the status of any processor remotely via the network.
- T. The ability to communicate with all other models of programmable controller manufactured by said manufacturer.
- U. The Programmable Controller shall have one dedicated serial port which supports RS-232-C signals. It shall be accessible in ladder logic and provide support for Point to Point and Slave communication protocol systems. Alternatively, it must be usable for programming purposes or for access to remote programmers via modems.
- V. The Programmable Controller shall have one dedicated serial port which supports RS-485 signals. It shall be accessible in ladder logic and provide support for DH485 protocol systems. It must be usable for programming purposes.
- W. Bi-directional communication between the programmable controllers and the communication network via a standard modem interface. The protocols shall meet EIA RS-232-C electrical standards and ANSI standard communication protocols.

- X. The processor shall have built-in diagnostics and self-test, such that each time power is cycled, the processor does a complete CPU and RAM memory test. Additionally the power-up test will momentarily light up all diagnostic LED's to be sure they are working. A power up test will not be performed if the internal flag (bit) for Fireman's Service Phase I is latched. The processor shall be capable of reporting major and minor fault codes and processor status information back to the polling master, provided the fault is not a catastrophic hardware failure where the processor is unable to power up.
- Y. The processor shall have a built-in watchdog timer to ensure that all processor program scans occur within the time limit set by the watchdog timer. The watchdog timer cycle shall be adjustable from 20 msec to 2.5 seconds in 10 msec increments.
- Z. The processor shall have individual LED indicators that are clearly visible and labeled for easy identification. At a minimum the following indicators must be provided:
1. CPU is in RUN mode
 2. CPU is FAULTED
 3. CPU battery is LOW
 4. I/O points are FORCED and are not under program control
 5. COMMUNICATION channels are active.
- AA. The controller shall be designed to operate automatically on standby power.
- BB. Elevator Drive System
1. Non-Regenerative Variable Voltage Variable Frequency Drive: The drive shall be microprocessor and IGBT based using vector control algorithms. The algorithms shall incorporate a motor model to determine the electromagnetic state of the motor. The motor model shall also encompass a temperature compensation algorithm which is essential for speed accuracy.
 2. Velocity shall be controlled by a feedback loop to within +/- 2% of contract speed and speed shall be independently supervised.
 3. Position of floors in the building shall be learned during a slow speed setup run. Once learned, floor locations shall be stored in non-volatile memory. Power loss shall not require the floors to be re-learned. Stopping accuracy shall be +/- 5 mm or less. Re-leveling shall be automatic.
 4. Resistors shall be provided to absorb the power regenerated by the motor. They shall dissipate power only when the motor is regenerating. Control shall be by IGBT.
 5. Maximum total harmonic distortion shall not exceed IEEE Std. 519 to be measured at the elevator disconnect.
- CC. Dielectric Matting: Dielectric rubber matting to be supplied on floor in front of controller to prevent accidental shock.
- DD. Controller Room Intercom/Two Way Communication Device: Provide within each controller/machine room a two way communication/ intercom that will interface with any type of ADA compliant telephone. Intercom shall be mounted directly on or within hands distance proximity to the elevator controller. Intercom shall be manufactured by Electronic Micro Systems Inc. (www.electronicmicrosystems.com) Model # SHWMRI-2 and or approved equal. Intercom system shall be provided with the following:
1. NEMA 4X Enclosure
 2. Handset
 3. Two (2) Phone Line capability

- A. General: Except as otherwise indicated, provide manufacturer's signal equipment for each elevator or group of elevators. Provide Cab Call Station Panel and Car Position Indicator and boxes in each car, Hall Call Station box on each landing for each elevator. Provide vandal resistant illuminated buttons and signals, which light-up when activated and remain lighted until call or other function has been fulfilled; Raised and Braille Tags; Tactile and Braille Plates; Alarm and Emergency buttons and key switches as required. Panels and components shall be Adams Elevator Equipment Company "Survivor/Plus" design or approved equal by the Authority. Fabricate equipment exposed surfaces of stainless steel with manufacturer's standard directional polish to match #4 finish.
- B. Furnish and install a system to provide for 2-way communications between the Cab Call Station Panel in each Passenger Elevator cab or each Hall Call Station and the remote CTA Control Center in accordance with ADA. Provide communications instrument with the following features:
1. Each instrument shall be fabricated and installed in such a manner that the instrument will appear to be an integral part (as opposed to an obvious "add-on") of the elevator cab control panel or each hall call station. Properly identify communication instrument with the same type of symbols as the cab operating station and hall call station.
 2. Each instrument shall be a heavy-duty hands-free speaker phone, FCC registered, DTMF signaling, telephone line powered. Each instrument shall provide automatic dialing of a preprogrammed telephone number consisting of from one (1) to twelve (12) digits, plus control digits for pause. The amount of time for pause shall be cumulative. Each time the pause digit is pressed, the amount of time shall increase for each pause sequence. Each instrument shall provide for pre-recorded message playback, which may be activated by the remote telephone by pressing one (1) or two (2) DTMF buttons. The instrument shall be equipped with non-volatile memory (no power or battery back-up required) to store the automated telephone number and the recorded message. Each instrument shall be capable of being programmed remotely, using a standard telephone instrument. Programming shall be password protected.
 3. Each instrument shall be capable of auto answer allowing incoming calls to be received. (Pre-recorded message from 2.04, SIGNAL EQUIPMENT, B.2. shall be available with incoming calls). Each instrument shall be equipped with vandal-resistant L.E.D. (Light Emitting Diode) which shall indicate when a call has been connected (both automatic outgoing or incoming). Each unit shall disconnect automatically after a pre-set time duration. Time shall be programmable by remote telephone instruments and shall be password protected.
 4. All instrument shall terminate in the associated elevator equipment room onto the binding posts of terminal blocks provided by the Elevator Contractor. The terminal blocks shall be model RPT12 as manufactured by Reliable Electric/Utility Products or approved equal. The Communications Contractor shall complete the termination of the instruments by splicing onto the jacketed stub.
- B. Cab Call Station Panel and Box: Provide flush-mounted panel and box containing call button for each landing served, and containing other buttons, switches and controls required for specified car operation and control at each specific elevator. All Cab Call Station Panel components shall be vandal resistant. Mount panels and components as indicated, or scheduled, at height complying with ADA requirements. Provide operating device symbols with tactile/ Braille, raised and Braille markings as required by code, CTA and ADA requirements. Control buttons shall be designated by raised and Braille characters, size shall be minimum 5/8 inch high. Service panel door lock shall receive 6 pin Best cylinder. Other keyed switches shall be standard keys keyed alike.
- C. Provide the words "NO SMOKING CITY ORDINANCE" by engraving in stainless steel

and fill with red enamel paint. Engrave with 5/8" high Helvetica medium uppercase letters. Show location and spacing of words on elevator shop drawings.

- D. Provide new vandal resistant illuminated buttons, size shall be a minimum of 3/4 inch in the smallest size, raised or flush.
- E. Car Position Indicator: Provide illuminated-signal vandal resistant jewel Car Position Indicator equal to Adams "Survivor/Plus" design or approved equal by the Authority. Locate above car door opening or above Cab Call Station Panel, location in Cab Call Station Panel is not acceptable. Provide an audible signal in connection with an illuminated signal in accordance with ADA Standards as the car passes or stops at a floor served. Characters shall be minimum of 1/2 inch high.
- F. Cab Service Panel: Provide and coordinate the following functions with Cab Call. Station Panel and box, components, location and communications;
 - 1. Keyed fan switch.
 - 2. Keyed light switch.
 - 3. Keyed light ray switch.
 - 4. Keyed inspection switch (cylinder).
 - 5. Telephone jack.
 - 6. No glass panel in door.
 - 7. Lock in door to receive 6 pin Best cylinder.
- G. Alarm Call Button and Two-way Communications Function shall activate communications instrument to allow passenger to talk to Customer Assistant Shelter and Control Center. Alarm Call Button shall provide 2 contact closures and simultaneous contact opens to operate remote monitoring equipment. Provide red jewel button.
- H. Emergency Stop Key Switch and Bell: Key switch shall be Best Lock Corp. No. CXT
 - 1. Emergency Stop Key Switch shall operate function designed to cut off current supply to motor, apply brake and bring the car to rest independent of the regular operating devices. Turning key switch stops car and activates communications instrument to allow passenger to talk to Customer Assistant Shelter and Control Center. Emergency Stop Key Switch shall provide 2 contact closures and simultaneous contact opens to operate remote monitoring equipment. Turn key switch to reactivate elevator indicator.
- I. Hall Call Station: Provide panel and box equal to Adams "Survivor/Plus" with flat face plate and illuminated vandal resistant halo round buttons with visual signal to indicate when call is registered and when call is answered, but provide single button where only one direction is possible. Provide Tactile/Braille Tags equal to Adams Series A-45I, modified with words and arrow symbol as indicated on the Drawings. Provide all components in accordance with ADA Standards.
 - 1. Provide "CTA ASSISTANCE" engraved at speaker and vandal resistant button as indicated on the Drawings, with Tactile/Braille Phone Symbol Tag equal to Adams Series A-451. Provide red jewel button.
 - 2. In conjunction with hall lantern device, provide an audible signal in accordance with ADA Standards to indicate that a car is arriving in response to a hall call, sound once for the "UP" direction and twice for the "DOWN" direction.
 - 3. Elevator key lockout switch control closes doors if they are open; disconnects power; leaves cab lighting on; operates only when car is at same level as switch.
 - 4. Access Key Switch operates cab from hall station.
 - 5. Provide Best cylinders.

- J. Hall Lantern: Provide new Hall Lanterns and box with visible and audible signal in accordance with ADA Standards, equal to Adams "Survivor/Plus". New units shall match materials, finishes and mounting method similar to Hall Call Stations.
1. Audible signal shall sound once for the "UP" direction and twice for the "DOWN" direction.
 2. Signal shall be visible from the vicinity of the Hall Call Station.
 3. Visual elements shall be at least 2-1/2 inches in the smallest dimension, mounted so that their centerline is at least 72 inches above the floor.
- K. Hoistway Entrance Door Jamb Tag Raised And Braille Characters: All elevator hoistway entrances shall have raised and Braille floor designations provided on both jambs, equal to Adams Series A-4500 modified 3 inches width by 4 inches height, stainless steel plate, brushed stainless finish characters with black background. The centerline of the characters shall be 60 inches above the finish floor. Characters shall be 2 inches high. Provide "Star" designation in addition to floor designation at landing of main egress indicated on the drawings.
- L. Emergency Battery Unit: 12 volt sealed rechargeable battery for emergency cab lighting and alarm bell, duration of four (4) hours when not connected to a "reliable source" of power.

2.06 PASSENGER ELEVATOR CAR ENCLOSURES

- A. General: Except as otherwise indicated, provide car enclosures, of the design and selections indicated on the drawings. Include ventilation, lighting, ceiling finish, stainless steel operable windows, stainless steel wall finish, access doors, doors, power door operators, nickel silver sills (threshold), trim, accessories, and floor finish.
1. Elevator car frame shall be of welded or bolted ASTM 123 galvanized steel channel uprights affixed to crosshead and plank channels with welded or bolted bracing members and gusset plates.
 2. The car platform shall be designed to accommodate one-piece loads weighing up to 25% of the APTA rated load.
- B. Provide stainless steel horizontal sliding doors of design indicated on the drawings, operation and number of panels as indicated. Provide manufacturer's standard protective edge trim system for door and wall panels, except as otherwise indicated.
- C. Materials and Fabrication: Provide selections as indicated for each enclosure surface; manufacturer's standards, but not less than the following:
1. Stainless Steel Return, Doors and Frames: 18 gauge doors, 14 gauge frames and return, AISI type 302/304 No. 4 finish.
 2. Stainless Steel Wall Panels: Wall panels to allow for a recessed 4 inch high base consisting of same material as finished floor. Each side of elevator interior cab to be one piece of metal.
 3. Stainless Steel Interior Elevator Door and Walls: As selected by the Authority, use patterned 304 Stainless Steel, satin finish, 18 gauge thickness, Pattern No. 5WL/LTH by Rigidized Metals Corp. or approved equal.
 4. Nickel silver sills, extruded, ASTM B 151 (alloy UNS No. C74500), with grooved surface, 1/4 inch thickness, mill finish.
 5. Stainless Steel Operable Windows: 18 gauge frames, finish AISI type 302/304 No. 4 finish. Continuous piano hinges. Key locks at top and bottom.
 6. Glass Panels: 9/16 inch thick laminated safety glass permanently marked in gasket system. No glass within 24 inches of floor level.
 7. Fabricate stainless steel car door frame integrally with front wall of car.

8. Fabricate car with recesses and cutouts for signal equipment.
 9. Surround Lighting: Fluorescent light fixtures having ballasts rated for reliable lamp starting of -20 degrees Fahrenheit and lens panels of translucent polycarbonate complying with flammability requirements, unless otherwise indicated on drawings. Provide emergency cab lighting per ANSI-A17.1. One light fixture in each cab shall be equipped to provide emergency illumination when required as well as normal power illumination. This fixture shall be located over the cab control station. See Electrical Drawings for lighting fixture type.
- D. Elevator Floor: Elevator cab platform to be supported on and welded to metal channels integral with the cab structure. Elevator cab platform sub-floor to consist of one piece galvanized steel plate. A plywood subfloor is not acceptable. Thickness of plate, size and spacing of channels as required for design loads. Set height of platform to allow installation of the composition flooring to meet and be flush with the top of the elevator door sill.
1. Apply a clear sealer and waterproof membrane over the steel plate platform and the metal to which the base will be applied to. Type of sealer, waterproof membrane and application as recommended by the sealant manufacturer and the composition flooring manufacturer for compatibility.
 2. Over the floor, apply a composition resin floor with integral cove base. Resin floor to be Dugaflex CQ Flooring System consisting of Degadur R41 primer, Degadur 410 overlay, and Degadur R71 Topcoat as manufactured by BASF or approved equal. Install according to manufacturer's instructions. Color and pattern to be through the entire thickness of the material and as selected by the Authority from the manufacturer's standards.
 3. Seal the top of the composition flooring and base system with a sealer as recommended by the composition flooring manufacturer and installer. Apply the sealer according to the sealant manufacturer's and composition flooring manufacturer's directions.
 4. The top of the integral base shall also be secured by the continuous non-corrosive (aluminum) metal channel cap secured to the cab wall.
- E. Car Ventilation: Air handling capacity shall provide one air change per minute based on net interior car volume. Provide one hour of emergency ventilation.
- F. Handrails: Provide stainless steel handrails, on side walls and back wall (unless otherwise indicated to be installed on side walls only); either continuous or one hand rail per wall.
- G. Light-ray Protective Device: Provide electronic multi-beam array device projecting light beams across car entrance, which, when interrupted, will cause closing doors to stop and reopen. Provide keyed switch in car operating panel for disconnecting light-ray device without interrupting service.
1. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time period, through activation of light-ray protective device, a loud buzzer shall sound and doors shall begin to close at reduced rate of speed. Doors shall continue to close unless door light-ray protective device is activated, which shall cause doors to reopen. Process shall repeat continuously until obstruction is removed from entrance.
 2. A loud buzzer shall sound if the "door open" button is held for a long period of time.
- H. Passenger cab, call station, Customer Assistant intercom system to provide two-way communications between Customer Assistant and the elevator hoist and cab positions. Customer Assistant shall receive signal that communication is needed and shall enable

two-way conversation. Provide head end equipment. Locate controls in Customer Assistant Shelter alarm panel.

1. Provide communication between the machine room area and the elevator cab.
- I. CCTV Security Camera: Provide CCTV security camera for installation in ceiling of elevator cab. The camera shall have a continuous 360-degree field-of-view. The camera shall be a 1.2 megapixel digital IP camera, powered by in-line power over Ethernet (POE) for the CTA's network hub box. The camera shall be connected to a double Category -5/6 traveler cable in the hoistway and terminate in the elevator machine room for patch to CTA's network. The camera shall be 100% compatible with CTA's existing TelesteVMS video management/ recording system. The camera shall be Sentry360 model FSP-IP 1000 or engineer approved equivalent.

2.07 PASSENGER HOISTWAY ENTRANCES

- A. General: Except as otherwise indicated, provide stainless steel and laminated glass sliding, door-and-frame hoistway entrances; complete with track systems, hardware, safeties, sills and accessories. Match car enclosure doors for size, number of door panels, glass size and alignment, and door panel movement. Provide frame-section size and profile to coordinate with hoistway wall construction as indicated.
1. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
- B. Materials and Fabrication: Provide selections indicated, but not less than the following:
1. Stainless Steel Door Panels and Frames: Flush stainless steel construction, 18 gauge doors, 14 gauge frames, AISI Type 302/304 No. 4 finish. Transom shall be 16 gauge.
 2. Glass Panels: 9/16 inch thick laminated safety glass permanently marked in gasket system. No glass within 24 inches of floor level.
 3. Nickel Silver Sill with grooved surface 1/4 inch thickness, cast or extruded, mill finish and steel angle (ASTM A36 steel). Sill shall be through bolted to angle, allow for expansion to prevent sill from buckling. Provide nickel silver sills at all hoistway openings.
 4. All switches, door operators and other electrical equipment exposed in the hoistways shall be of drip proof design such that water from floor cleaning operations, rain and snow do not affect equipment operation.
- C. Provide loud alarm bell outside hoistway. Connect bell to emergency stop buttons in cab panels.
- D. Door Hangers and Tracks: Furnish and install for each hoistway entrance, a total of two necessary hangers and tracks complete. Hangers shall be of sheave type arranged for two point suspension of the doors. Hanger brackets shall be integral with the door or applied. Sheaves and rollers shall be provided to take the up thrust of the doors. Tracks shall be cold drawn or cold rolled steel of smooth surface and the working section shall be cleaned and oiled with wick type lubricators.
1. Hangers shall be designed for power operation with provisions for vertical and lateral adjustment.
 2. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.
- E. Car and Hoistway Doors: Doors on the car and at each hoistway landing shall be operated quietly and smoothly by an electric operator which shall open the car door and hoistway door simultaneously and close the car door and hoistway door simultaneously.

1. An electric contact for the car door shall be provided which shall prevent elevator movement away from the landing unless the door is in the closed position, as defined in the Code.
2. Each hoistway door shall be equipped with a positive electromagnetic interlock and auxiliary door closing device so that the elevator can be operated only after the interlock circuit is established. The interlock operation shall comply with the Code.
3. The door shall open automatically as the elevator is leveling and close either after expiration of a time interval or the moment a car button call is registered. If desired it shall be possible to open the doors manually from within the car.
4. The electronic protective device shall extend the full height of the car door. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.
5. Provide to the Authority all tools necessary to adjust and maintain the door operator.

2.08 ELECTRICAL AND COMMUNICATION COMPONENTS

- A. All electrical components shall satisfy the City of Chicago Building Code.
- B. All conduits used in elevator shaft and machine room shall be heavy wall rigid hot dipped galvanized steel except where specified or indicated otherwise.
- C. All boxes and fittings in the shaft shall be cast metal or malleable iron.
- D. All control equipment shall be mounted in 12 gauge NEMA 12 cabinet with hinged door.
- E. All wiring in the control panel shall be neatly installed and terminated in the terminal blocks. All terminals shall be clearly marked. All components in the control panel shall be identified and matched to components as indicated on the wiring diagram.
- F. Cab lighting, fan and alarms shall be connected to reliable power.
- G. Recessed lighting in the cab shall have stainless steel door frame with prismatic polycarbonate lens, unless otherwise indicated on drawings.
- H. Provide at least 3 sets Auxiliary contacts in control panel for each remote alarms or indications.
 1. Emergency alarm.
 2. Emergency stop.
 3. Elevator malfunctions.
- I. Complete wiring diagram showing the electrical connections, functions and sequence of all apparatus connected with the elevator (including door operators) both in machine room and hoistway shall be furnished for review and record.
- J. Custom travel cables shall include all wires required for elevator cab power, communication, security systems and controls in compliance with latest applicable codes. These include as a minimum:
 1. Acceptable manufacturers include:
 - a. Berk-Tek Products, by Nexans; 1.800.237.5835.

- b. Or approved equal.
2. 2 coaxial shielded cables. Coaxial cables shall be 75-ohm, designed and manufactured specifically for repetitive movement and flexing in elevator hoistways. Cables shall extend from car junction box to junction box in hoistway and continue to elevator machine room for termination.
 3. (6) Cat-6 twisted shielded pairs for security and telephone systems. Category-5e/6 twisted pair cables shall be designed and manufactured specifically for repetitive movement and flexing in elevator hoistways. Traveller cables will provide 100Mbps ethernet signaling from a surface mount closed circuit television (CCTV) IP camera in the elevator cab junction box to a demarcation point in the elevator machine room.
 4. Provide four strand traveler fiber optic cable from elevator control panel to elevator cab. Provide Perle 1000 Base-T to 1000 Base-X fiber media converter and Cisco SRW208MP 8-port 10/100 Ethernet Switch, or approved equal, at elevator cab and elevator control panel. Make required connections from converters to elevator cab devices and elevator control panel via Cat-6 cables.
 5. Provide separate traveling cables for car lighting and fan control circuits.
 6. Provide traveling cable for telephone in the elevator car. Cable shall extend from car junction box to junction box in hoistway and continue to elevator machine room for termination.
 7. Provide traveling cable for car work lights. Cable shall extend from junction box in hoistway to car junction box.
 8. Provide 25 percent spare wires (control and communication) in the traveling cable from the hoistway to the cabinet in the elevator cab.
 9. The emergency stop switch in the car shall be connected to all alarm bells in a manner that will cause the bells to ring when the emergency stop switch is in the "On" position.
- K. Elevator drive system power requirement to be 208 volts, 3 phase, 3 wire, 60 Hertz terminating in a disconnect switch within sight of the controller.
1. Motor: 10.4 HP
 2. Nameplate Amps: 42
 3. Fusetron: 60 Amp
 4. Full Load Duty: 32 Amps
 5. Maximum Acceleration Amps: 59
 6. Controller BTU output: 3.3 KBTU/HR (Controller room temperature range requirement is 40 F to 104 F)
- L. For lighting and GFCI receptacles: 120 volts, 1 phase, 3 wire, 60 Hertz terminating at the elevator controller location.
- M. Provide separate disconnect for cab lighting and wiring to cab. Provide a separate disconnect for sill heaters.
- N. All cabinets containing motor drives, filter boxes, transformers and power reactors shall be supported on rails and isolated from the base building structure with elastomer pads having a minimum static deflection of 3/8". All connections to and from the cabinetry shall be flexible in order not to compromise the isolation system. Use flexible conduit for the final electrical connection, with all other conduit supports and clamps provided on a neoprene sponge insert. Cabinets shall be NEMA 4X.

- O. Supply, installation and connections of fused main line disconnect switch shall be of the lockable type for the elevator.
- P. Signal to the controller to indicate special emergency condition due to lobby smoke detector activation; and smoke detectors in the elevator lobby and controller space in accordance with the ASME A17.1 code.
- Q. Car lighting and fan circuit for the elevators shall be located in circuit breaker panel in the controller space.

2.09 LUBRICATION

- A. Provide grease fittings at all bearings requiring periodic lubrication including automatic feed compression type grease cups. Lubrication points shall be visible and easily accessible.

2.10 INTERCOMMUNICATION SYSTEM AND OPERATION

- A. The work shall include the furnishing and installation of a system to provide for 2-way communications between the cab control panel in each Passenger Elevator cab or each Hall Call Station and the Customer Assistant's Kiosk and the remote CTA Control Center in accordance with ADA. Provide communications instrument with the following features:
1. Each instrument shall be fabricated and installed in such a manner that the instrument will appear to be an integral part (as opposed to an obvious "add-on") of the elevator cab control panel or each hall call station. Properly identify communication instrument with the same type of symbols as the car operating station and hall call station.
 2. Each instrument shall be a heavy-duty hands-free speakerphone, FCC registered, dual tone multifrequency signaling, telephone line powered. Each instrument shall provide automatic dialing of preprogrammed telephone number(s) consisting of from 1 to 12 digits, plus control digits for pause. The amount of time for pause shall be cumulative. Each time the pause digit is pressed, the amount of time shall increase for each pause sequence. Each instrument shall provide for pre-recorded message playback, which may be activated by the remote telephone by pressing one or two DTMF buttons. The instrument shall be equipped with non-volatile memory (no power or battery back-up required) to store the automated telephone number and the recorded message. Each instrument shall be capable of being programmed remotely, using a standard telephone instrument. Programming shall be password protected.
 3. Each instrument shall be capable of auto answer allowing incoming calls to be received. (Pre recorded message from INTERCOMMUNICATION SYSTEM AND OPERATION shall be available with incoming calls). Each instrument shall be equipped with vandal-resistant L.E.D. (Light Emitting Diode) which shall indicate when a call has been connected (both automatic outgoing or incoming). Each unit shall disconnect automatically after a pre-set time duration. Time shall be programmable by remote telephone instruments and shall be password protected.
 4. All instruments shall terminate in the associated elevator equipment room onto the binding posts of terminal blocks provided by the Elevator Contractor. The terminal blocks shall be model RPT12 as manufactured by Reliable Electric/Utility Products or approved equal. The Communications Contractor shall complete the termination of the instruments by splicing onto the jacketed stub.

2.11 MONITORING SYSTEM

- A. Provide the following:
1. Allen Bradely MicroLogix 1500 based RTU cabinet to interface the elevator controller to the existing CTA Oculus Network Server systems. The RTU cabinet will interface to the elevator controller via serial communications. Provide the interfacing cable for installation by Contractor.
 2. Develop and configure Human Machine Interface (HMI) screens for the elevator system integration into the Oculus Network Server system
 3. Coordinate data exchange between the Oculus Network Server and the CTA InView CMMS system.

4. The monitoring system to monitor new elevators and existing escalators.
5. Remote and central monitoring station computer shall have ethernet interface and TCP/IP communications to connect to CTA's network.

B. Contractor shall provide and install the following:

1. Communication panel for connection of the RTU cabinet to the CTA supplied WAN connection using CAT 6 cabling. Communication panel shall include the following:
 - a. 24" x 24" x 8" Enclosure Nema 4 Stainless Hinged Door w/ Lock Hasp and Mounting Panel, J & A Sheet metal or approved equal.
 - b. Cisco Catalyst 6500 Series 8700W Enhanced AC Power Supply, or approved equal.
 - c. Cisco SRW208MP 8-port 10/100 Ethernet Switch - WebView/Max PoE, or approved equal.
 - d. Leviton eXtreme 6+ Universal Patch Panel, Model # 69586-C48), or approved equal.
 - e. Protected Terminal Block - PR Circa Model R66P25, or approved equal.
 - f. 12 Strand Fiber Patch Panel, Corning Model SPH-01P, or approved equal.
2. Installation of the contractor supplied RTU Cabinet in the elevator machine room including all conduit and Ethernet cabling systems.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to commencing elevator installation, examine hoistways, hoistway openings, pits, sumps, drainage, and machine room areas, as constructed; verify all critical dimensions and examine supporting structure and all other conditions under which elevator work is to be installed. Notify the Authority in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of elevator work. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
1. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work until dimensions are within tolerances.
 2. Verify projections greater than 2 inches are beveled not less than 75 degrees from horizontal.
 3. Verify landings have been prepared for entrance sill installation.
 4. Verify elevator pit has been constructed in accordance with requirements, is dry and reinforcement to sustain vertical forces, as indicated in approved submittal.
 5. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.
 5. Verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including sleeves and penetrations.
 6. Verify installation of GFCI protected 20-amp outlet in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

- A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

- B. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
 - 1. Ensure adequate support for entrance attachment points at all landings.
- C. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
- D. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
- E. Coordinate interface of elevators and fire alarm system, smoke and heat detectors.
- F. Coordinate interface of dedicated telephone line, communication equipment, and security system.
- G. Coordinate work with other trades, including electrical.

3.03 INSTALLATION OF ELEVATOR SYSTEM

- A. General: Comply with manufacturer's instructions and specifications for work required during installation.
- B. Welded Construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Coordination: Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.
- D. Sound Isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts designed to effectively prevent transmission of vibrations to structure and thereby, eliminate sources of structure-borne noise from elevator system.
- E. Install equipment, guides, controls, car and accessories in accordance with manufacturer's installation methods and recommended practices.
- F. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration structure.
- G. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.
- H. Lubricate operating parts of systems, including ropes, if any, in accordance with manufacturer's recommendations.
- I. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- J. Leveling Tolerance: Leveling 1/4 inch, up or down, regardless of load and direction of

travel. Guide rail alignment within 1/8 inch in 12 feet not to exceed 1/4 inch overall, plumb and parallel.

- K. Set sills flush with finished floor surface at landings, use non-shrink, non-metallic grout, minimum 3,000 psi if required. Coordinate with other trades to facilitate and ensure proper grouting of sills.

3.04 ADJUSTMENTS

- A. Perform final adjustments and necessary service prior to substantial completion.

3.05 FIELD QUALITY CONTROL

- A. Acceptance Testing: Upon nominal completion of each elevator installation, and before permitting use of elevator (either temporary or permanent), perform acceptance tests as required and recommended by Code and by governing regulations or agencies.
- B. Operating Tests: Load each elevator to its rated capacity and operate continuously for 30 minutes over its full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of pump motor (except submerged pumps) during 30-minute test period. Record failures of elevator to perform as required.
- C. Advise the Authority and inspection department of governing agencies in advance of dates and times tests are to be performed on elevators.

3.06 PROTECTION AND CLEANING

- A. Provide suitable protective coverings, barriers, devices, signs, or such other methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout installation period.
- B. Upon acceptance by the Authority or when directed, remove protection and clean exposed and finished surfaces.
- C. During installations, and until elevator systems are fully operative, Contractor shall make necessary provisions to protect systems from damage, deterioration, injury to public and environmental conditions.

3.07 DEMONSTRATION

- A. Instruct the Authority's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train the Authority's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with the Authority on requirements for a complete elevator maintenance program. Provide manuals for all material covered in the training program. The training shall take place at the discretion of Authority at any time prior to the end of the warranty period.
 - 1. Provide 3 – eight (8) hour sessions.
 - 2. Additionally, supply a 60 minute (minimum) video tape describing:
 - a. Daily maintenance.
 - b. Emergency procedures.
 - c. Troubleshooting procedures for electrical and mechanical failures and malfunctions. Include in this video, the following specific troubleshooting procedures:

- 1) How to load digital/logic programming for controllers when it loses memory.
- 2) Procedures for resetting faults, door operator, and diagnostic training.

B. Make a final check of each elevator operation with the Authority's personnel present and just prior to date of Final Acceptance. Determine that control systems and operating devices are functioning properly.

3.08 TESTING AND INSPECTIONS

A. Contractor shall obtain and pay for all necessary permits and perform such tests as may be required for acceptance and approval of elevators by Jurisdictional agencies.

B. Contractor shall notify the proper inspectors to witness required testing.

3.09 WARRANTY INSPECTIONS

A. In addition to any warranty provisions covered by these specifications, the Contractor shall perform complete inspections of the elevators and all associated systems and controls. The inspections shall be no less than eight (8) hours each elevator and be conducted Monday to Friday, during normal daytime hours. The warranty inspections shall take place during the twelve (12) month period from the date of final acceptance by the Authority of each elevator installation. The Authority's representative will accompany the Contractor on the inspections.

B. The Contractor shall prepare and submit to the Authority a written report with two (2) copies, stating the condition of the equipment outlining any modifications to the maintenance specifications or operational procedures and respond in writing to questions raised by the Authority or maintenance personnel during the inspection periods.

C. As part of the inspections, Contractor shall at no cost to the Authority completely inspect and adjust machinery, and replace any parts showing undue wear, or tendencies toward malfunction, or any items indicating a need for modifications or design change. This shall be furnished as part of the guarantee obligation by the Contractor.

D. The inspections shall be performed by the Contractor's service representative. All costs involved with each of these inspections such as travel, accommodations, international charges, fees, tools, equipment and parts costs, shall be paid in full by the Contractor.

E. Contractor shall notify the Authority in writing at least two (2) weeks prior of the intent to conduct the elevator warranty inspections.

ELEVATOR SCHEDULE - TRACTION PASSENGER UNITS

Elevator Type:	Electric Traction Passenger
Elevator Quantities:	1
Capacity :	2,500 pounds
Rated Speed:	100 feet per minute
Travel Distance:	11'-9" +/- V.I.F.
Number of Landings:	Two (2)

Openings: Two (2) Front and Rear Openings.

Note: Travel distances are not guaranteed and the Contractor shall verify measurements in the field.

Stops: Normal And Emergency Operation: 2
Machine: Geared traction with a.c. variable voltage motor.
Power Supplied: 208 volts a.c., 3 phase, 60 hertz, separate equipment
grounding conductor.
Operation: Simplex.
Control System: Solid- state-microcomputer.
Auxiliary Operations: Emergency power operation, all levels.
Signal Equipment: As Specified.
Car Enclosures: 4'-3" wide x 8'-0-1/2" deep (inside).
Height: 8'-0" minimum ceiling height inside cab.
Door Type: 3'-0" x 7'-0" double, side opening slide, power operator.
Machine Location: Machine Room adjacent to Station Level Hoistway
Control Space Location: Machine Room adjacent to Station Level Hoistway
Car Performance: Car speed plus or minus 5% of contract speed under
any loading condition or direction of travel.
Car Capacity: Safely lower, stop and hold (per code) up to 125% of
rated load.

System Performance: Vertical Vibration (maximum): 15-17 mg.
Horizontal Vibration (maximum): 10-12 mg. Jerk Rate (maximum): 3.3 – 5.25 ft/sec².
Acceleration (maximum): 1.6 – 2.6 ft/sec². In Car Noise: = 55 dB(A).
Leveling Accuracy: Plus or minus 3 mm. Starts per hour (maximum): 240.

Finish: Stainless steel interior, perimeter lighting soffit, vinyl
flooring.

Hoistway Entrances: Stainless steel frames.

Additional Requirements: Heat trace sills at cab and hoistway

END OF SECTION 14 21 00

SECTION 22 00 00
MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY OF MECHANICAL WORK

- A. The general work associated with mechanical systems and equipment, and to be performed as mechanical work, includes pipe sleeves, pipe supports, anchors, vibration isolation, welding, identification, record drawings, installation permits, tests, inspections, mechanical temporary facilities, cutting-and-patching work, utility connections, training of Authority's operating personnel, operating and maintenance manuals, final cleaning, lubricating, and similar work. Specific mechanical work is indicated on the contract drawings and can be generally summarized as (but is not necessarily limited to) the following:
1. Mechanical work including but not limited to providing new HVAC equipment, exhaust fans, refrigerant piping, controls, and refrigerant pipe insulation, etc.
 2. Obtaining and payment for permits, licenses and certificates of inspection necessary for the execution and completion of Contractor's work.

1.02 CUTTING AND PATCHING

- A. Cut and patch building materials as required for the installation of work. Do not cut structural framing, walls, floors, decks and other members intended to withstand stress. Holes cut in structural steel must be drilled or punched. Cut openings through concrete (for pipe penetrations and similar services) by core drilling or sawing. Execute patching in the manner recommended by the Installer trade. Restore the cut work in every respect, including the elimination of visual defects in exposed finishes.

1.03 CONTRACT DRAWINGS AND SPECIFICATIONS

- A. The Contract Documents are in-part diagrammatic, unless specifically dimensioned, in showing the general arrangement, and approximate sizes of equipment. Certain physical relationships which must be established within the mechanical work, and in its interface with other work is the responsibility of the Contractor. The Contract Documents indicate the best available information on existing conditions, utilities, services, and on new services (if any) to be provided to the project. Accuracy of this information is not assured and must be verified in field by the Contractor.
- B. The intent and purpose of Drawings and Specifications are that all necessary labor and materials be provided for completion of all the work specified. The systems installed shall be complete in all details, including all minor items, accessories or devices necessary for a complete operational system ready for service, whether or not they are specifically called for in the Specifications or on the Drawings.

1.04 FIELD VERIFICATION

- A. Contractor shall review the Drawings, Specifications and visit the Site before submitting Contractor's bid. Contractor shall examine areas and conditions under which mechanical work is to be installed, and notify General Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

1.05 MECHANICAL SYMBOLS

- A. Mechanical Contract Drawings are diagrammatic and show requirements by use of graphic symbols. Symbols and Abbreviations drawings are provided. In general, these are recognized symbols of industry and the engineering profession.

1.06 MECHANICAL STANDARDS

- A. Where indicated, comply with requirements and recommendations of standard or publication listed, except to the extent more detailed and stringent requirements are indicated or required by governing regulations.

ASME	American Society of Mechanical Engineers
AWS	American Welding Society, Inc.
AWWA	American Water Works Association, Inc.
CISPI	Cast Iron Soil Pipe Institute
MCA	Mechanical Contractors Association of America, Inc.
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
NEC	National Electrical Code by NFPA
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Association
PDI	Plumbing and Drainage Institute
SMACNA	Thermal Insulation Manufacturers Association
UL	Underwriters Laboratories, Inc.

1.07 BUILDING CODES AND ORDINANCES

- A. Materials, installation and workmanship shall comply with applicable codes, local ordinances, regulations, industry standards, utility company regulations and all requirements of local authorities having jurisdiction. Where these Contractor Documents are at variance, the most stringent shall govern. The Contractor shall notify the Authority in writing of discrepancies

1.08 COORDINATION

- A. The Contractor is responsible for the coordination of work by the different sub-contractors to avoid interferences and delays. The Authority is not responsible for coordination of construction. In the event that interferences occur between the different trades, the Contractor shall decide as to which trade shall relocate its work at no additional cost to Authority.
- B. For locations where several elements of mechanical or electrical work must fit into the available space, prepare coordination shop drawings showing the actual physical dimensions at an accurate scale. Submit prior to purchase-fabrication-installation.
- C. Install piping and similar services straight and true, aligned with other work, close to walls and overhead structure, concealed in occupied spaces, and out-of-the-way with maximum passageway and headroom remaining in each space.
- D. Arrange mechanical work in a neat, well organized manner running parallel with primary lines of the building construction, and with a minimum of 7'-0" overhead clearance where possible. Give right-of-way to piping which must slope for drainage. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate operating and control equipment and devices for easy access.

1.9 SUBMITTAL FORM AND PROCEDURES

- A. Unless specified otherwise, submit the following as required for each major mechanical item, for review and approval by the Authority:
1. Shop Drawings
 2. Samples
 3. Manufacturer's Data
 4. Certifications
 5. Test Reports
 6. Product Warranties
 7. Operational Instructions
 8. Maintenance Manuals
 9. Guarantees
- B. Where standard product data have been submitted in fulfillment of project requirements, it is recognized that the Contractor has already determined that the products fulfill the specified requirements, and that the submittal is for information only. Where uniquely prepared information is submitted, it is recognized to represent the Contractor's interpretation or solution to the specified requirements, subject to the Authority's approval. Contractor shall coordinate mechanical submittals and mark each submittal with his name and the date of transmittal to the Authority.

1.10 GENERAL MANUFACTURER QUALIFICATIONS

- A. Manufacturers shall be firms regularly engaged in manufacturer of equipment and products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver products properly identified with names, model numbers, types, grades, compliance labels. Adequately package or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected specifically for exterior storage. Coordinate the deliveries of mechanical materials and products with the scheduling and sequencing of the work so that storage requirements at the site are minimized.

1.12 SUBSTITUTIONS

- A. Bidders base proposal shall be based on named manufacturers only; Proposed substitutions shall comply with Division 01 and shall include cost of all changes associated with the substitution to include changes to other trades to retain a coordinated system. The burden of proof for data related to substitutions rests with the Contractor. The Change Order procedure of Division 01 is mandatory for the acceptance of proposed substitutions.

PART 2 PRODUCTS

2.01 GENERAL MECHANICAL PRODUCT REQUIREMENTS

- A. Provide materials and factory-fabricated products of sizes, types, ratings, and capacities as indicated. Where not indicated, provide proper selection complying with the Specifications and governing regulations. Where more than one type is indicated, selection is the Contractor's option.
- B. Quality: Provide no less a quality than manufacturers' standard products, as specified by their published product data while complying with the specified requirements. Do not assume that the available off-the-shelf condition of a product complies with the requirements. Do not purchase specific mechanical materials and equipment for the project until completion of submittals which might affect the purchase.
- C. Condition: Except as otherwise indicated, provide new mechanical products, free of defects and harmful deterioration at the time of installation. Provide each product complete with trim, accessories, finish, guards, safety devices and similar components specified or recognized as integral parts of the product, or required by governing regulations. To the greatest extent possible and unless otherwise indicated, complete the fabrication, assembly finishing and testing of products prior to delivery to the project.
- D. Uniformity: Where multiple units of a generic product are required for a single major system, provide identical products by the same manufacturer, without variations except for size and similar variations as indicated. Product/manufacturer uniformity does not apply to raw materials and bulk materials.
- E. Compatibility: Where more than one product selection is specified, either generically or proprietary, selection is the Contractor's option. Provide adaptations as needed for interfacing of selected products in the work.
- F. Nameplates: Provide a permanent operational data nameplate on each item of power operated mechanical equipment, indicating the manufacturer, product name, model number, serial number, speed, capacity, power characteristics, labels of tested compliances, and similar essential operating data. Locate nameplates in easily-read locations; except where product is visually exposed in occupied areas of the building, locate nameplate in a concealed position which is accessible for reading by service personnel.

2.02 PRODUCT INSTALLATION GENERAL

- A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning, testing, charging, lubrication, start-up, test operation, and shut-down of operating equipment.
- B. The Contractor shall be a firm with at least 3 years of successful installation experience on similar projects.
- C. All moving parts of equipment or machinery such as gears, pulleys, belts, links, etc., shall be covered or guarded in an approved manner as required by the provisions of all Federal, State or Local codes, Regulations or laws. All guards shall be constructed of metal of not less than 16 gauge.

PART 3 EXECUTION

3.01 RECORD MECHANICAL DRAWINGS

- A. Unless specified otherwise in Division 01 maintain a white-print set of the Mechanical Drawings and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Obtain a set of erasable mylar transparent originals for each Contract Drawing and each Shop Drawing and use to record installed conditions. The "Field Record" drawings shall be submitted to the Authority for approval before final payment will be made on the contract. Record every substantive installation of mechanical work which previously is either not shown or shown inaccurately, but in any case record the following:
1. Concealed piping drawn to scale and fully dimensioned.
 2. Work concealed in a non-accessible arrangement.
 3. Valves, sensors, and control devices and items requiring maintenance.

3.02 SYSTEM PERFORMANCE TEST RUN

- A. With Authority's Representative present, operate each system in a test run to demonstrate compliance with performance requirements. Make final corrections or adjustments of systems to refine and improve performances. Demonstrate that controls and items requiring service or maintenance are accessible.

3.03 CLEANING AND LUBRICATION

- A. After final performance test run of each mechanical system, clean system both externally and internally. Flush piping systems. Clean strainers and traps. Lubricate equipment and remove excess lubrication. Touch-up minor damage to painted finishes.

3.04 GENERAL OPERATING INSTRUCTIONS

- A. Conduct a full-day minimum walk-through explanation and demonstration for orientation and education of Authority's personnel to be involved in continued operation of building and its mechanical plant. Describe each system, its control system, flow adjustments, temperature control and similar operation. Explain identification system. Describe sequencing, interlock provisions, shut-down and season operations. Emphasize emergency procedures and safety provisions during equipment malfunction, disasters, power failures and similar unusual circumstances. Describe system limitations and precautions including weather adjustments. Outline basic maintenance procedures. Explain maintenance manuals, record drawings, spare parts inventory, storage of extra materials, meter readings and similar service items.

3.05 CONTINUED SYSTEMS OPERATIONS

- A. At time of substantial completion of mechanical work, Authority's operating personnel will take over operation of mechanical systems. Respond promptly with consultation and services on whatever operation or maintenance problems may remain or arise in continued operation until expiration of guarantee period.

3.06 CLEANUP

- A. Remove all rubbish resulting from the work as it accumulates leaving the premises in a clean and acceptable condition at all times. On completion of work, remove from the Site tools, equipment and surplus materials pertaining to the operations.

3.07 GUARANTEES

- A. Guarantees shall be in accordance with the Contract Documents.

END OF SECTION 22 00 00

SECTION 22 05 00
BASIC PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, material, equipment, and services in conformance with the requirements for Basic Plumbing Materials and Methods as specified herein.

1.02 RELATED WORK:

- A. Division 22 Section, Plumbing.

1.03 SUBMITTALS

- A. The Contractor shall furnish shop drawings, product data and samples in accordance with the requirements of Division One Section, Submittal Procedures, and as required below:
 - 1. Refer to Sections 22 40 00 for the submittal requirements.
- B. The Contractor shall furnish operating instructions and maintenance specifications/requirements in accordance with the requirements of Division One Section, Closeout Procedures.

1.04 QUALITY ASSURANCE

- A. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place.
- B. Code Ratings, labels or other data which are die-stamped or otherwise affixed to the surface of the equipment shall be in visible location.
- C. All equipment provided under Division 22 shall perform with the least possible noise and vibration consistent with its duty. Quietness of operation of all equipment shall be a requirement. Any equipment, as determined by the Authority, to be producing objectionable noise or transmitting noise or vibration to the building shall be repaired or removed and replaced.

1.05 REFERENCES

- A. Standards: Refer to individual system specifications in Section 22 40 00 for a list of standards.
- B. Manufacturer's Catalogs: Refer to individual system specifications in Sections 22 40 00 for a list of manufacturers relative to each particular system.

1.06 SEQUENCING/SCHEDULING

- A. The Contractor shall schedule and perform tasks required for furnishing and installing the Basic Materials and Methods in conformance with the requirements of the accepted project schedule.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Follow manufacturer's directions in the delivery, storage, protection and handling of all equipment and materials.
- B. Deliver and store equipment and materials to the site in original containers, sheltered from the elements and mechanical injury. Items subject to moisture damage shall be stored in dry, heated spaces.
- C. Ascertain whether any temporary access openings in the building will be required for the admission of apparatus and notify the General Contractor accordingly.

1.08 PROTECTION

- A. Keep pipe and duct openings closed by means of plugs or caps; cover all fixtures, equipment and apparatus to protect them against damage, both before and after installation.
- B. Provide protective guards for devices such as thermostat, valves, and switches which are located in elevator and escalator pits, stairwells and where directed by Engineer.
- C. Protect all work against injury by freezing or exposure to the weather while stored or installed in place. All motors shall be wrapped for protection against excessive humidity before the building is enclosed.
- D. Motors exposed to any amount of moisture shall be completely dried out before connection and start-up, supplying trade responsible until Authority's acceptance.
- E. Fans not in operation shall have shafts rotated by hand each week.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

- A. Refer to the individual duct and piping system specification sections in Division 22 for specifications on piping and fittings relative to that particular system.

2.02 PIPING SPECIALTIES

- A. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
 - 1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, or weld neck and types and matching piping system materials.
 - 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
 - 3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure to suit system pressures.
 - 4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum working pressure to suit system pressures.
 - 5. Dielectric-Flange Insulation Kits:
 - a. Field-assembled, companion-flanged assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - b. Provide separate companion flanges and steel bolts and nuts for 150 or 300 psig minimum working pressure to suit system pressure.

6. Dielectric Couplings: Galvanized-steel coupling, having inert and non-corrosive, thermoplastic lining; with threaded ends and 300 psig minimum working pressure at 225^o F temperature.
7. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive, thermoplastic lining, with combination of plain, threaded, or grooved end types and 300 psig working pressure at 225^o F temperature.
8. Refrigerant Piping Specialties:
 - a. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.
 - b. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
 - c. Moisture/Liquid Indicators: 500 psig maximum operation pressure, 200^oF maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
 - d. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
 - 1) Standard capacity desiccant sieves to provide micron filtration.
 - 2) High capacity desiccant sieves to provide micron filtration and extra drying capacity.
 - e. Flanged Unions: 400 psig maximum working pressure, 330^oF maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8" through 1-5/8" unions shall be forged steel, and for 2-1/8" through 3-1/8" shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.
 - f. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7" in length. Install at condensing unit and evaporator coil connections.

2.03 MOTORS

- A. Electric motors and starters required for the motor-driven equipment shall comply with the requirements of Division 26 Sections - Electrical.

2.04 GUARDS

- A. All belt, pulleys, chains, gears, couplings, projecting set screws, key and other rotating parts shall be fully enclosed and properly guarded.
- B. Guards shall be constructed of not less than 1 inch x 1 inch x required length structural steel angles and ½ inch diamond mesh enclosure or equally suitable enclosure, with packaged equipment.
- C. Guards shall be secured to the driven machines or to foundations or floors by heavy structural angle supports and anchor bolts. Braces or supports secured to motors will not be permitted, and braces and/or supports must not "bridge" the sound and vibration isolators.

- D. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall also be provided to permit lubrication, use of speed counters and other maintenance and testing operation with guard in place.
- E. All guards shall comply with OSHA requirements.

2.05 VALVES

- A. Refer to Section 22 40 00 - Plumbing for specifications on valves, relative to that particular system.
- B. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install valves with stems pointed up, in vertical position where possible, but not with stems pointed downward from horizontal plane unless unavoidable.

2.06 MECHANICAL INSULATION (SEE SECTION 22 07 00)

- A. FS HH-I-558 Fiberglass Insulation as follows:

<u>ITEM</u>	<u>FORM</u>	<u>TYPE</u>	<u>CLASS</u>	<u>BEARING</u>	<u>REMARKS</u>
Pipe	D	III	12	---	To 45 ⁰ F
Pipe	E	---	16	---	To 45 ⁰ F

- B. Flame/Smoke Ratings: Provide composite mechanical insulation, jackets, coverings, sealers, mastics and adhesives with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less as tested by ANSI/ASTM E 84 (NFPA 255).
- C. Vapor Barrier Material: FS HH-B-100, paper-backed aluminum foil, strength and permeability rating equivalent to adjoining insulation jacketing. Low vapor transmission Type I for ducts in exposed areas and pipe. Medium vapor transmission Type II for ducts in concealed areas.
- D. Provide staples, bands, wires, wire nettings, tape, anchors, corner angles, stud pins, metal covers, adhesives, cements, sealers, mastics, coatings, protective finishes, similar compounds and accessories as recommended by insulation manufacturer.
- E. Install insulation materials on clean and dry surfaces, after test acceptance. Do not apply on hot surfaces. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Insulate each continuous run with full-length units of insulation, with single cut piece to complete run. Do not cut pieces or scraps abutting each other. Insulation shall have smooth and even outside surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship. Cover insulated surfaces with glass cloth jacketing neatly fitted and firmly secured. Lap seams at least two inches. Apply over vapor barrier where applicable. Extend insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated. On insulated equipment, breeching and stacks, apply using staggered joint method for both single and double-layer construction where feasible. Apply each layer of insulation separately.
- F. Provide products manufactured by one of the following:
 1. Armstrong World Industries, Inc.
 2. Babcock & Wilcox Co., Insulating Products Div.

3. Certainteed Corp.
4. Johns-Manville.
5. Keene Corp.
6. Owens-Corning.
7. Rubatex Corp.
8. Pittsburg Corning Corp.

2.07 ALUMINUM JACKETING (SEE SECTION 22 07 00)

- A. All straight runs of pipe insulation are to be protected with Childers Corrolon jacketing. The jacketing is to be manufactured from .016" type 3003 or 5005 Aluminum. All jacketing shall have an integrally bonded polykraft moisture barrier over the entire surface in contact with the insulation. All jacketing shall be installed in accordance with Childers latest published recommendations.
- B. All 90^o and 45^o insulated elbows having a nominal Iron Pipe Size of 1/2" to 12", inclusive, shall be protected with Childers Aluminum Ell-Jacs manufactured from 1100 Aluminum alloy in .024" thickness. The E11-Jacs shall be installed in accordance with Childers' latest published recommendations.
- C. Other Manufacturers:
 1. Owens Corning.
 2. Johns Manville.

PART 3 EXECUTION

3.01 GENERAL

- A. Refer to Section 22 40 00 - Plumbing for piping installation.

3.02 MECHANICAL INSULATION

- A. Install insulation materials on clean and dry surfaces, after test acceptance. Do not apply to hot surfaces. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Insulate each continuous run with full-length units of insulation, with single cut piece to complete run. Do not cut pieces or scraps abutting each other. Insulation shall have smooth and even outside surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship. Cover insulated surfaces with glass cloth jacketing neatly fitted and firmly secured. Lap seams at least two inches. Apply over vapor barrier where applicable. Extend insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated. On insulated equipment, breeching and stacks, apply using staggered joint method for both single and double-layer construction where feasible. Apply each layer of insulation separately.

3.03 HANGERS AND SUPPORTS

- A. All piping and equipment shall be adequately supported, either suspended from the construction above, or by means of struts to the construction below. Comply with MSS SP-69 and SP-89.
- B. Provide:
 1. Approved type inserts for support of work in case of concrete construction.
 2. Approved type forged steel beam clamps in the case of steel construction.

3. Supplementary angles, channels, plates, etc., where supports are required between building structural members, spanning the space and attached to building structural members by welding, bolting or with concrete anchors.
 4. All rods, angles, rails, struts, brace plates, platforms, etc., required for suspension or support of piping, ducts and equipment.
 5. Hangers, rollers, threaded rods, turnbuckles, saddles, insulation protectors, anchors, etc., and all miscellaneous specialties for the attachment of hanger and supports to the structure.
 6. Where additional hangers are required, provide ITT Philips "Red Head" self drilling anchors of the size required by hanger rod size and the imposing loading. Anchors shall not be installed in concrete beams or girders. Anchors shall be installed in accordance with manufacturer's recommendations. Anchor bolts shall be case hardened steel of the type to meet manufacturer's recommended safe working load of anchor.
- C. Unless otherwise noted, the piping shall be supported as described under Section 22 40 00 - Plumbing.
- D. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded.
- G. Insulated Piping: Comply with the following installations requirements:
1. Clamps: Attach clamps, including spaces (if any) to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
 2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
- H. Structural Steel Supports: All structural steel used in the fabrication of pipe and duct supports, including cross members, steel shapes and plates, shall conform to ASTM Specification A-36. Steel shall be well formed to shape and size. Shearing and punching shall leave clean, true lines and surfaces. Carefully match exposed work to produce continuity of line and design. All joints, unless otherwise shown or specified, shall be accurately fitted and rigidly secured with hairline contact. Thickness of metal and details of assembly and support shall give adequate strength and stiffness.

3.04 PIPE SLEEVES

- A. Provide pipe sleeves for all pipes which pass through walls, partitions, floors, ceilings, or roofs, in accordance with Section 22 40 00 - Plumbing.

3.05 EQUIPMENT IDENTIFICATION

- A. All pumps, fan systems, etc., as well as their motor starters, shall be identified by 1/8 inch thick, white with black core laminated phenolic nameplates. Equipment plates shall be 1½ inch x 4 inch with 3/16 inch lettering, and adhered with adhesive furnished by plate manufacturer.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

3.06 IDENTIFICATION OF PIPING

- A. All service piping which is accessible for maintenance operations (except piping in finished spaces) shall be identified with semi-rigid plastic (not pressure-sensitive) identification markers or equal. Direction of flow arrows shall be included on each marker, unless otherwise specified.
- B. In conformance with "Scheme for the Identification of Piping Systems" (ANSI A13.1) and OSHA, each marker shall show (1) approved color--coded background, (2) proper color of legend in relation to background color, (3) approved legend letter size, and (4) approved marker length.
- C. For pipes under 3/4 inches O.D. (too small for color bands and legends), brass identification tags 1-1/2 inch in diameter with depressed 1/4 inch high backfilled letters above 1/2 inch back-filled numbers shall be fastened securely at specified locations.
- D. Locations for pipe markers shall be as follows:
 1. At each branch and riser take-off excluding short take-off for fixtures.
 2. At each pipe passage through wall, floor and ceiling construction.
 3. At each pipe passage to underground.
 4. On all horizontal pipe runs - marked every 25 feet.
- E. Pipe markers shall be as manufactured by Seton Name Plate Corp., New Haven, Connecticut, 06505; Badger Tag & Label Company; Bunting Stamp, Inc., or approved equal.

3.07 OPERATING AND MAINTENANCE MANUALS AND PARTS LISTS

- A. Each manual shall contain all information pertinent to the equipment and essential for good preventive maintenance practice, and for efficient replacement of all expandable components.
- B. The manual shall generally include the items listed below and other features as may be recommended by the manufacturers:
 - 1. Catalog information of the unit installed.
 - 2. Capacity and installation details.
 - 3. Wiring diagrams of electrical components.
 - 4. Special valves and control devices.
 - 5. All points requiring lubrication and type of lubricant.
 - 6. Frequency of lubrication.
 - 7. Operating pressure and temperatures.
 - 8. Relief devices and setting.
 - 9. Electrical characteristics of all motors and frame numbers.
 - 10. Operating curves of all pumps and all fans.
 - 11. Exploded view of all machinery.
 - 12. Complete list of parts, including a list of spare parts recommended to "keep on hand" for ordinary service requirements, with re-ordering numbers and current pricing.
 - 13. Name, address, and telephone numbers of all local service parts depots of equipment furnished.
- C. Manuals for instructions shall be complete and explicit, including instructions for start-up, operation and stopping. Critical points of operation and hazardous limits shall be boldly underscored and emphasized.
- D. The above information shall be provided for the following and for all other equipment where it is necessary to have the aforementioned data:
 - 1. Fans (with fan data sheets).
 - 2. Fan drives.
 - 3. Motors.
 - 4. Motor controls.
 - 5. Plumbing fixtures, faucets, and flush valves.
 - 6. Pumps (with curves for actual impeller installed).
 - 7. Relief valves.
 - 8. Temperature control systems (as installed).
 - 9. Valves.
 - 10. Vibration isolator units.
 - 11. Specialties, etc.

3.08 ALIGNMENT OF ROTATING EQUIPMENT

- A. All pumps or similar equipment directly connected to motors by means of flexible couplings shall be perfectly aligned after installation by the use of a dial indicator, and the work of alignment shall be performed by a craftsman skilled in the work.
- B. Belted equipment shall be aligned so that the grooves of the driver pulley are truly aligned with those of the driven sheave, and the belts shall be in the proper tension free from flutter. In multi-belt drives, all belts shall be operated in the same plane. Flutter in any one belt will be cause to reject the entire set, as the original installation of belts shall be in matched sets as elsewhere specified.

- C. All equipment provided with high capacity belt drives shall be conveniently tagged and so identified for future servicing and replacement of belts.
- D. Before any rotating equipment is put in operation for testing purposes, it shall be properly lubricated with lubricants only as specified by the manufacturer and they shall be further lubricated before the equipment is turned over to the Authority.
- E. The Contractor shall furnish the Authority with a lubrication schedule for all rotating equipment installed on this Contract.

3.09 GROUTING FOR MACHINERY BASES

- A. Provide necessary grouting for all steel and cast iron bases for pumps and other equipment requiring same.
- B. Grout shall be Master Builders Co., "EMBEKO" No. 636; Five Star Products; Micor Co., Inc. or approved equal, mixed in strict compliance with manufacturers specifications.
- C. Grout shall be introduced into equipment base plates and shall be well rodded in place to prevent any air cavities forming during placement of the grout.

3.10 FLASHING SLEEVES

- A. Wherever pipes pass through the roof, furnish and install Zurn Figure Z-195-10, Josam, Jay R. Smith or approved equal, flashing sleeves, installed in accordance with manufacturer's instructions. See typical detail on drawing.
- B. Flashing sleeves shall be provided with 18 ounce copper flashing extending not less than 19 inches beyond the largest diameter of opening.

3.11 LUBRICATION

- A. The Contractor shall lubricate all motors, bearings, etc., in connection with his/her equipment until installation is completed, accepted and turned over to the Authority. Lubrication tag showing initials of person doing the lubrication and date of lubrication shall be attached to all machines.

3.12 NOISE AND VIBRATION CONTROL

- A. Make provisions in the installation of work so that noises or vibrations shall not be transmitted through foundations, floors, walls, columns, ducts, piping, etc., so as to be not objectionable in any manner. All equipment provided shall be selected and installed with this in view. If any equipment exceeds reasonable requirements as to quietness of operation and freedom from vibration when operating under continuous maximum demands, it shall be altered or replaced.
- B. Furnish and install vibration eliminators and isolation equipment as manufactured by the Vibration Eliminator Co.; Korfund; Mason Industries, or approved equal, for equipment, fans, motors, pumps, etc., as indicated on the drawings, specified or as required.
- C. The isolation and vibration eliminator manufacturer and Contractor shall be responsible for the selection of the power units for their loadings, quantities, etc., and he/she shall guarantee that each and every installation and their application shall have a vibration efficiency of 90% or greater. As a minimum, provide types of vibration eliminators as indicated on the drawings.

- D. Submit shop drawings to the Authority for approval of all isolation equipment, with dimensions and other data as specified and prepared by the isolation equipment manufacturer.

3.13 CONCRETE PADS AND FOUNDATIONS

- A. Concrete housekeeping pads and foundations, ready for the installation of equipment thereon, shall be provided under another trade. Furnish information such as size and location concerning all concrete foundations, equipment pads plus all mounting bolts and templates and any openings required.

3.14 WIRING DIAGRAMS

- A. Contractors shall provide each major piece of electrically connected, controlled or operated equipment with specific wiring diagrams and instructions. Diagrams and instructions shall not be of a general or typical nature but applicable only to the specific job. The diagrams and instructions used to install the equipment shall be identical to that included in the "Instruction and Maintenance Manuals".

3.15 RECORD DOCUMENTS

- A. Provide records for all revisions and deviations to the originally issued Contract Documents.

3.16 TOOLS

- A. On completion of the Work, the Contractor shall furnish and deliver to the Authority any special tools that may be required for the proper servicing of any equipment he/she has furnished on the project.

3.17 PAINTING

- A. All shop fabricated and factory built equipment not primed, galvanized or protected by plating shall be cleaned and given one (1) shop coat of zinc-chromate primer before delivery to the site. Any portions of the shop coat damaged in delivery or during construction shall be re-coated. Piping, ductwork and equipment shall be left cleaned and primed, ready for finish painting. All finish painting will be done under Section 09 90 00: Painting.
- B. Do not paint nameplates, labels, tags, sprinklers, stainless steel or chromium-plated items such as valve stems, motor shafts, levers, handles, trip strips, etc.

3.18 CLEANING - GENERAL

- A. Maintain the premises in an orderly fashion at all times, providing continuous clean-up during the construction period. Remove all cartons, containers, crates, etc., as soon as their contents have been removed and also remove all debris caused by work as soon as possible. Deposit all discarded materials in a suitable refuse container and prevent these materials from being scattered by the elements. All cartons, debris, etc., shall be removed from the premises and site at the sole expense of the Contractor.
- B. Contractor shall stack all construction materials associated with this work in areas so as to avoid congestion and interference with other trades.
- C. At the completion of the Work, the Contractor shall clean all of his/her work, equipment, etc., free from dust, etc. and shall leave the Work in good housekeeping fashion, in a manner acceptable to the Authority.

3.19 GUARANTEE

- A. Guarantee all materials and workmanship furnished and installed under this Contract for a period of one year form the date of Final Completion and Acceptance of these items.
- B. Other specific Guarantees of greater duration and called for in the Specifications shall not be abrogated by this Guarantee.

END OF SECTION 22 05 00

SECTION 22 07 00
PIPE INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall furnish all labor, material, equipment, and services necessary to furnish and install pipe insulation at the location as directed and required by the Authority.

1.02 RELATED WORK:

- A. Section 23 07 00, Mechanical Insulation.

1.03 SUBMITTALS

- A. The Contractor shall furnish product data, technical data, samples, installation instructions and shop drawings as required below:
 - 1. Product Data: Provide product description, list of materials, and thicknesses for each type and application of insulation, cement, adhesive, sealant, tape, attachment device, jacket, cover and other accessory.
 - a. Provide specifications and test data indicating thermal performance standards of insulating products.
 - b. Provide data for each insulating product indicating thickness of material and related R value.
 - 2. Provide product data, specifications, technical data and shop drawings for any equipment insulation indicating thickness, R values, size and profile of equipment to be insulated, location of protrusions, access requirements, method of attachment and seam closure method.
 - 3. Samples: Submit two (2) samples of any representative size illustrating each insulation and accessory type. Provide samples of any jackets or covers in actual color and finish to be supplied.
 - 4. Manufacturer's installation instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.
 - 5. Manufacturer's certificate of compliance and thermal efficiency.
 - 6. Copy of manufacturer's warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer of insulation shall have been producing the products successfully for a period of at least five years and be able to provide documentation that the products meet all specified requirements.
- B. The material(s) required for the pipe insulation work will be furnished by the Contractor. All material(s) furnished by the Contractor shall be new and shall meet the standards and requirements specified by the applicable institutions and organizations (i.e. ASME, ASTM, NFPA, and EPA), and local building codes.
- C. All installation of insulation shall follow the insulation manufacturer's recommended procedures and meet the standards and requirements specified by the applicable institutions, organizations, Federal, State, and Local building codes.

1.05 REFERENCE STANDARDS

- A. American Society for Testing and Materials:
 - 1. ASTM E 84, Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
 - 1. NFPA 255, Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters' Laboratories:
 - 1. UL 723 Fire and Smoke Hazard Classification.

1.06 SEQUENCING/SCHEDULING

- A. The Contractor shall schedule and perform tasks required for furnishing and installing the thermal insulation and accessories in conformance with the requirements of the accepted project schedule.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation products to the site in unbroken shipping cartons bearing a label indicating the contents and the appropriate ASTM, NFPA and UL flame and smoke hazard ratings as specified herein for the various insulation products.
- B. Deliver and store insulation products protected from the weather. Store insulation on the site elevated off wet and otherwise contaminating surfaces.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 PIPE INSULATING MATERIALS, GENERAL:

- A. Rigid Insulation on Piping: Use rigid insulation manufactured of molded glass fiber with composite (insulation, jacket or facing, and sealing adhesive) fire and smoke hazard ratings meeting requirements of NFPA 90A Standards, tested per ASTM E 84, NFPA 255 and UL 723, not to exceed a "Flame Spread" rating of 25 and a "Smoke Developed" rating of 50 except as noted herein. Products or their shipping cartons shall bear a label indicating above requirements. Insulation shall have a maximum thermal conductivity of 0.23 BTUH per sq. ft. per degree F. per inch at 70 degrees F. mean temperature. The water vapor transmission rating shall be less than 0.2 perms per inch using a jacket of white kraft bonded to aluminum foil and reinforced with fiberglass yarn.
- B. All exterior piping, whether heat traced or not, shall be insulated with cellular glass type insulation having integral self sealing jacket.
- C. Fitting Insulation (Rigid): Insulate fittings and valve bodies with factory-premolded one-piece insulation. Insulation inserts of noncombustible glass fiber shall have a K factor of .27 at 75 degrees F. mean temperature.

D. Acceptable Manufacturers of Insulating Materials:

1. Johns-Manville, J-M Flame-Safe AP.
2. Owens-Corning Fiberglass.
3. Certain-Teed.
4. Pittsburgh Corning.

E. Acceptable Manufacturers of Aluminum Jacketing:

1. Childers.
2. Johns Manville.
3. Owens Corning.

2.02 INSULATING CEMENTS

A. Mineral Fiber certified to meet the requirements specified in the current edition of ASTM C 195.

1. Thermal Conductivity: Average max. 1.0 BTU in./h ft² °F at 500 °F mean temperature.
2. Minimum compressive strength: 10 p.s.i. at 5 percent deformation.

B. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement certified to meet the requirements specified in the current edition of ASTM C 449.

1. Apparent Thermal Conductivity: Average max. 1.2 BTU in./h ft² °F at 400 °F mean temperature.
2. Minimum compressive strength: 100 p.s.i. at 5 percent deformation.

2.03 PREFORMED GLASS FIBER

A. Molded and jacketed inorganic glass fibers, bonded with a thermosetting resin, into products preformed via a molding process to yield rigid full-round cylindrical pipe insulation sections, certified to meet the requirements specified in the current edition of ASTM C 547, for Type I insulation.

1. Apparent Thermal Conductivity: Average max. 0.26 BTU in./h ft² °F at 75 °F mean temperature.
2. Density: Average max. 10 lb/ft³

B. Surface Burning Characteristics: All preformed glass fiber insulation shall have composite (insulation, jacket, tape seal, and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard ratings as tested in accordance with the current editions of ASTM E 84, NFPA 255 and UL 723, not exceeding

1. Flame Spread 25
2. Smoke Developed 50

C. Hot-Surface Performance: All preformed glass fiber insulation shall not flame, glow, smolder, crack, delaminate or warp after 96 hours exposure to the heated surface of a heating pipe when tested in accordance with the current edition of ASTM C 411.

- D. Jacketing: The preformed glass fiber insulation shall be furnished with either a foil and paper jacket with end joint butt strips or an aluminum jacket. All jacketing shall conform to the requirements specified herein under Article 3.1.5-Jackets.

2.04 JACKETS

- A. Foil and Paper Jacket- Laminated glass-fiber-reinforced, flame-retardant Kraft paper and aluminum foil having self-sealing lap conforming to the current edition of ASTM C 1136, Type I, and ASTM C 921, Type I or Type II.
1. Water Vapor Permeance: 0.02 perms maximum, when tested in accordance with the current edition of ASTM E 96.
 2. Puncture Resistance: 50 beach units minimum, when tested in accordance with ASTM D 781-84.
- B. Aluminum Jacket - Aluminum jacketing material shall be Alloy 3003, H14 temper roll stock, ready for shop or field fabrication to required sizes, in compliance with the current edition of ASTM B 209.
1. Finish and Thickness: Smooth finish, 0.010 inch to 0.016 inch thick.
 2. Moisture Barrier: Factory applied 1-mil, heat bonded polyethylene and Kraft paper.
 3. Moisture Barrier: Factory applied 3-mil Dupont Surlyn, or approved equal.
- C. Aluminum fitting jackets shall be factory preformed from the same material having the same finish, moisture barrier, and thickness as that specified for jackets.
- D. All straight runs of pipe insulation are to be protected with Childers Corrolon or approved equal aluminum jacketing. The jacketing is to be manufactured from .016" type 3003 or 5005 aluminum. All jacketing shall have an integrally bonded polykraft moisture barrier over the entire surface in contact with the insulation. All jacketing shall be installed in accordance with manufacturer's latest published recommendations.
- E. All 90 degree and 45 degree F insulated elbows having a nominal iron pipe size of ½" to 12", inclusive, shall be protected with Childers Aluminum Ell-Jacs or approved equal manufactured from 1100 Aluminum alloy in .024" thickness. The Ell-Jacs shall be installed in accordance with manufacturer's latest published recommendations.

2.05 STANDARD PVC FITTING COVERS

- A. Factory-fabricated fitting cover consisting of one-piece, pre-molded, PVC covers manufactured from 20-mil thick, high-impact, ultraviolet-resistant PVC.
1. Shapes: 45- and 90-degree, short- and long-radius elbows, reducers, end caps, soil-pipe hubs, traps, mechanical joints, roof drains, and P-trap, in compliance with the current edition of ASTM C 585.
 2. Smooth high gloss surface that does not promote bacteria or fungi growth.

2.06 ATTACHMENTS, ADHESIVES AND SEALANT MATERIAL

- A. Metal bands shall be ¾ inch wide x 0.020 inch thick Type 304 stainless steel.
- B. Wire tie material shall be one of the following: 14 gage nickel-copper alloy, 16 gage soft-annealed stainless steel, or 16 gage soft-annealed galvanized steel as indicated in the contract document.

- C. Adhesives for the flexible elastomeric cellular insulation shall be solvent based, and suitable for the insulation furnished as recommended by the insulation manufacturer.
- D. Adhesives for rigid preformed glass fiber insulation shall be non-flammable, solvent based and have a service temperature range of minus 20 °F to plus 180 °F.
- E. Vapor Barrier Compound shall be a water-based fire-resistive composition exhibiting the following characteristics.
 - 1. Water Vapor Permeance: 0.08 perm maximum.
 - 2. Temperature Range: Minus 20 °F to plus 180 °F.
- F. Weatherproof Sealant: Flexible-elastomer-based, vapor barrier sealant designed to seal metal joints.
 - 1. Water Vapor Permeance: 0.02 perm maximum.
 - 2. Temperature Range: Minus 50 °F to plus 250 °F.
 - 3. Color: Aluminum.

PART 3 EXECUTION

3.01 INSPECTION

- A. Carefully inspect installed work of other Trades in connection with insulating work and verify such work shall be complete, including system or equipment testing, to such point where insulating work may begin.
- B. Verify that piping has been tested and approved before applying insulation materials.

3.02 PREPARATION

- A. Apply insulation on clean, dry surfaces only and without foreign materials. Perform cleaning required for removal of construction debris, spills, etc. prior to installation.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Install insulation continuous through structure penetration of surfaces being insulated. All pipe insulation shall be continuous through walls, ceilings, floor openings or sleeves except where firestop or firesafing materials are required.
- C. Insulation installed on piping operating below ambient temperatures shall have a continuous vapor barrier. Adequately seal hanger, support, and anchor penetrations of insulation. All joints, seams and fittings shall be sealed with approved materials.
- D. Apply specified insulation adhesive, sealers and coatings at the manufacturer's specified minimum coverage per gallon.

3.04 PIPING INSULATION:

- A. Apply insulation materials on piped services listed and in accordance with thicknesses listed below. Insulate fittings and valve bodies and in-line control devices, except gage and thermometer faces, setting or measuring scales integral with in-line devices and control handles. Do not insulate unions or flanges.

- B. Rigid Insulation Installation: Install on piping according to manufacturer's instructions, using specified adhesive to seal both longitudinal jacket laps and butt strips. Insulate in-line appurtenances with factory-premolded one-piece insulated covers as previously specified. Secure fitting cover by stapling first followed by a tape sealing using tape specified by the fitting cover manufacturer. Install insulation in thickness as follows:
1. Domestic hot & cold water in heated spaces - 1 inch thick; in unheated spaces - 2 inches thick.
 2. Soil, waste and vent piping in heated spaces - 1 inch thick; in unheated spaces - 2 inches thick.
 3. Horizontal downspouts - 1 inch thick.
 4. All heat traced piping - 2 inches thick minimum.
 5. Refrigeration piping - 1 inch thick minimum
 6. Drain line from fan coil drip pan - 1 inch thick minimum
- C. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement applied in two inch thick coats. Install the glass reinforcing mesh in the first coat while tacky and allow to dry before applying the second coat. Cover with aluminum jacket with seams located on bottom side of horizontal piping and facing building wall on vertical pipe. Secure cover with ½ inch wide aluminum draw bands on maximum 2 foot (610 mm) centers, or edges with aluminum sheet metal screws on maximum 4 inch (102 mm) centers. Caulk seams with flexible latex caulking.
- D. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- E. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- F. Insulate piping and equipment less than 8 feet above finished floors in locations accessible to personnel contact so that temperatures of exposed surfaces do not exceed 180 degrees F (82 degrees C).
- G. Carry vapor barriers down and seal to the cold surface at not more than 50 foot (15 meters) intervals on horizontal runs and at not more than 10 foot (3 meters) intervals on vertical runs.
- H. Seal hanger rods on pipes carrying fluids of less than 70 degrees F (21 degrees C) to a point of 2 inches (51 mm) minimum above the top of the insulation where the insulation is penetrated.
- I. Vapor barrier jackets may be all purpose jackets, foil-scrim-kraft jacket, minimum 3 mil plastic sheeting, or spray on plastic coatings.
- J. Provide a factory or field applied fiberglass cloth jacket over all vapor barriers, except all purpose jackets, on all piping exposed to view or specified to be painted.
- K. Provide a factory or field applied fiberglass cloth jacket over all thermal insulation exposed to view or specified to be painted, except all purpose jackets. Size all insulation exposed to view in accordance with section painting.

- L. Adhesives and fasteners used to secure jackets and covers on insulation shall be vermin, rodent and mildew resistant and have a smoke and flame spread rating equal to or greater than the insulation on which applied.
- M. Apply insulation so that it does not interfere with the operation of control valves or servicing of equipment, valves or controls. Apply insulation so that access doors, covers, panels and access plates on equipment and piping can be removed, opened or operated without damage to the insulation. Insulation shall not cover nameplates, inspection stamps, rating plates, code stamps, and similar information attachments.
- N. On high-temperature piping, provide double layering of insulation. Stagger insulation joints when more than one layer of insulation is applied.
- O. All ends of insulation materials shall be firmly butted and secured with appropriate butt strip materials.
- P. When installing insulation cover seams, locate in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

3.06 CLEANUP

- A. The Contractor shall ensure a general clean up is conducted at all work sites at the close of each workday. All waste material or rubbish (e.g. old insulation) must be disposed of in accordance with all applicable City and State regulations in effect for the work area, including disposal of waste in a licensed yard and/or refuse land fill.
- B. Contractor shall not dispose of waste material or rubbish into the Authority's refuse containers or anywhere else on or about the Authority's property.
- C. Contractor shall keep premises free from accumulation of waste material or rubbish as the work progresses. At completion of work, the Contractor shall remove all rubbish from the worksite and shall remove all tools, scaffolding and surplus materials, leaving the work area "broom clean". In case of dispute, the Authority may remove rubbish and charge such costs to the Contractor. Any damages caused by the Contractor, either directly or indirectly, shall be the sole responsibility of the Contractor.

3.07 DEFECTIVE MATERIALS OR WORKMANSHIP

- A. All material and workmanship covered by this specification shall be subject to the inspection and approval of the Authority and shall be in conformance with this specification, all relevant codes and requirements and good practice. All materials used for this work shall be new, in original packaging and undamaged prior to installation.
- B. Any defective material shall be immediately removed from the premises by the Contractor and replaced at no cost to the Authority. Any defective workmanship shall be promptly corrected to the satisfaction of the Authority and at no cost to the Authority.

END OF SECTION 22 07 00

SECTION 22 40 00
PLUMBING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, material, equipment, and services necessary to furnish and install PLUMBING at the location(s) shown on the Drawings and/or as specified herein.
- B. The plumbing work includes but is not limited to the following:
 - 1. Pipe and pipe fittings, valves.
 - 2. Plumbing Specialties: Floor and roof drains, cleanouts, etc.
 - 3. Plumbing fixtures: Toilets, urinals, lavatories, mop basins, etc.
 - 4. Faucet assemblies, hose bibs.
 - 5. Plumbing Equipment.
 - 6. Electric Water Heaters.
 - 7. Electric Water Coolers.
 - 8. Piping and equipment insulation.
 - 9. Sump pumps.
 - 10. Excavation and backfilling for water service and sewer connections.
 - 11. Hangers, sleeves, accessories, etc.
 - 12. Plumbing permits.
 - 13. Testing.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.03 RELATED WORK

- A. Sections that may contain information that relates to this section includes, but is not limited to, the following:
 - 1. Division 22 Sections, Plumbing Basic Materials and Methods.
 - 2. Division 22 Sections, Piping Insulation.
 - 3. Division 26 Sections, Electrical.
 - 4. Division 33 Sections, Site Utilities.

1.04 REFERENCES

- A. General: The work shall comply with or exceed the referenced standards and codes. Any work which cannot meet the referenced standards and codes shall be brought to the attention of the Authority for written approval before proceeding with the work.
- B. Codes: The work shall comply with the following codes:
 - 1. City of Chicago Building Code.
 - 2. State of Illinois Plumbing Code.
- C. Standards: The work shall comply with the following standards:

1. American National Standard Institute (ANSI)
 - a. ANSI A117.1 - Specifications for making building and facilities accessible to and usable by physically handicapped people.
 - b. ANSI A112.19.2M90 - Vitreous China Plumbing Fixtures.
 - c. ANSI B1.20.1 -Pipe Threads, General Purpose (Inch) Revision and Redesignation of ASME/ANSI B2.1.
2. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
 - a. ASHRAE 90A - Energy Efficiency and Conservation.
3. American Society of Sanitary Engineering (ASSE):
 - a. ASSE 1001 - Pipe Applied Atmospheric Vacuum Breakers.
 - b. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
4. American Society of Mechanical Engineers (ASME):
 - a. ASME/ANSI Sec. 9 - Welding and Brazing Qualifications.
 - b. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
 - c. ASME/ANSI B16.3 - Galvanized Malleable Iron Threaded Fittings.
 - d. ASME/ANSI B16.4 - Cast Iron Threaded Fittings Class 125 and 250.
 - e. ASME/ANSI B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
 - f. ASME/ANSI B16.12 - Cast Iron Threaded Drainage Fittings.
 - g. ASME/ANSI B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
 - h. ASME/ANSI B16.26 - Cast Bronze Fittings for Flared Copper Tubes.
 - i. ASME/ANSI B16.39 - Malleable Iron Threaded Pipe Unions.
 - j. ASME/ANSI B31.9 - Building Service Piping.
5. American Society of Testing and Materials (ASTM):
 - a. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 - b. ASTM A74 - Cast Iron Soil Pipe and Fittings.
 - c. ASTM A106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - d. ASTM B88 - Seamless Copper Water Tube.
 - e. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube.
6. American Water Works Association (AWWA):
 - a. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. ANSI/AWWA C510 - Double Check Valve Backflow-Prevention Assembly.
7. Electrical Components Standard: Provide components complying with NFPA 70” National Electric Code.”
 - a. Listing and Labeling: Provide water heaters that are listed and labeled.

- 1) The terms "listed" and "labeled" shall be as defined in the National Electric Code, Article 100.
 - 2) Listing and labeling agency Qualifications: A "Nationally recognized testing Laboratory" (NRTL) as defined in OSHA.
8. Underwriters Laboratories, Inc. (UL):
- a. UL 132 - Relief Valve and Automatic Shut-Off Device For Hot Water Supply Systems.
 - b. UL 174 - Electric Water Heater.
9. Miscellaneous Standards and Regulations:
- a. Environmental Protection Agency (EPA)
 - b. Clean Water Act (CWA)
 - c. Occupational Safety and Health Act (OSHA)
 - d. Manufacturer's Standardization Society MSS
- D. Conflicts: In all cases where conflicts exist in standards or codes, the more stringent requirement shall be followed. Where the Contract Documents are in excess of the referenced codes and standards, the Contract Documents shall be followed. All conflicts shall be brought to the attention of the Authority for written approval before proceeding with the work in question.

1.05 SUBMITTALS

- A. The Contractor shall furnish shop drawings, product data and samples in accordance with the requirements of the Division One Section, "Submittals" and as required below:
1. Shop Drawings of piping floor layouts in plan drawn to a minimum scale of 1/8" = 1' -0".
 2. Supply, Drainage, and Vent Plumbing Diagrams showing pipe sizes, shut off valves, provision for expansion, cleanouts, etc.
- B. Product Data: Submit for Authority's review, manufacturer's literature indicating installation instructions and dimensions, materials, accessories, performance information, certified performance curves, rated capacities, electrical requirements and wiring diagrams, standards listing, certification and guarantees for the following:
1. Piping, tubing, fittings and couplings.
 2. Joints and materials.
 3. Valves including intended service.
 4. Water heaters including all accessories.
 5. Air cushions, thermometers, gauges.
 6. Hangers and supports.
 7. Flashing and clamping flanges.
 8. Cleanouts.
 9. Floor drains.
 10. Plumbing Fixtures: Water closets, lavatories, mop basins.
 11. Faucet assemblies.
 12. Carriers and supports and flush valve assemblies.
 13. Flow control devices.
 14. Stops, strainers, traps, supplies and escutcheons.
 15. Elevator sump Pump and pit.
 16. Hose Bibbs.
 17. Product data submitted shall include specifications section and paragraph reference with intended use clearly indicated. A submittal shall be made for

review and approval for all items; even if already identified herein by manufacturer's model number.

- C. Test and Inspection Reports: Furnish within five (5) days of each test or inspection of any piping segment, equipment device, or system. Include all relevant information concerning the test or inspection, as provided in the format specified, including Contractor's Material and Test Certificates for the following item:
 - 1. Pressure Testing of Piping.
- D. The Contractor shall furnish operating instructions and maintenance recommendations and requirements in accordance with the requirements of Division One Section, Project Closeout.
- E. Certificates: Welding Certificate.
- F. Manufacturer List: Contractor shall forward to the Authority for preliminary review, a complete list of manufacturers of all material and equipment proposed to be incorporated into the work. The review of the list by the Authority shall be considered tentative and is further subject to submission and final review of shop drawings, catalog cuts, etc.
- G. Warranties: Submit copies of warranties for major components including water heaters, water coolers, plumbing fixtures, faucet assemblies, etc.

1.06 QUALITY ASSURANCE

- A. General: All materials shall be clearly stamped or tagged as required by the referenced standards. Any materials or workmanship which in the opinion of the Authority does not use the referenced standards and codes shall be discarded and replaced at the Contractor's expense.
- B. Authority's Review: No portion of any work shall commence until review of shop drawings and other submittals for that portion of the work has been completed and returned to the Contractor marked "Approved". All work shall be in accordance with and constructed from documents bearing the Authority's stamp of review.
- C. Manufacturer Qualifications: Subject to conformance with the requirements of the Contract Documents, the Contractor shall furnish plumbing materials and equipment manufactured by a company specializing in manufacturing the products specified in this section with a minimum of five (5) years documented experience.
- D. Installer Qualifications: Subject to conformance with the requirements of the Contract Documents, plumbing shall be installed by a company specializing in performing the work of the Section with a minimum of five (5) years documented experience.
- E. Regulator Requirements: City of Chicago Plumbing Code. All new plumbing fixtures to meet ADA codes and requirements.
- F. Welding: Qualifying welding procedures, welders and operators in accordance with ASME B31.9, as applicable, for shop and project site welding of pipe work. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).
- G. Code Ratings, labels or other data which are die-stamped or otherwise affixed to the surface of the equipment shall be in visible location.

- H. Electrical Components: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use and UL approved.

1.07 SEQUENCING/SCHEDULING

- A. The Contractor shall schedule and perform tasks required for furnishing and installing the plumbing in conformance with the requirements of the accepted project schedule.
- B. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division Three Sections, Concrete.
- C. Coordinate the installation of pipe sleeves for foundation wall penetrations.
- D. Coordinate the installation of downspouts, flashing, and roof penetrations.
- E. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- F. Coordinate the installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.
- G. Schedule fixture and piping rough-in with installation of other building components.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.09 WARRANTY

- A. All plumbing fixtures, faucets, equipment, and accessories including piping and valves shall be warrantied by the manufacturer and installer for a period of one (1) year after the date of final acceptance unless noted otherwise. If any item or installation is found defective, the item or installation must be repaired or replaced at no cost to the Authority for parts or labor, and upon the discretion of the Authority.
 - 1. The tankless electric water heater shall additionally have its heat exchanger warrantied for a period of ten (10) years and its other parts for a period of two (2) years. Warranty shall cover leaks, faulty operation, faulty controls, faulty wiring and connections, deterioration of metals, or insufficient heating of water.

PART 2 PRODUCTS

2.01 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

- A. Schedule 40 galvanized steel seamless pipe, ASTM A53, with 150 lbs. malleable iron threaded, galvanized and banded fittings, ANSI B16.3, for 2 inch and smaller waste and vent piping, all aboveground downspouts and sump pump discharge.
- B. Flanges: ASTM A106 galvanized. ANSI Class 150.
- C. Cast-Iron Soil Pipe: ASTM A74, Service weight, hub and spigot coated soil pipe and fittings, for 3 inch and larger sanitary drainage and vent pipe.
 - 1. Lead and Oakum Joints.

2.02 UNDERGROUND BUILDING DRAIN AND VENT PIPE AND FITTINGS

- A. Cast-Iron Soil Pipe: ASTM A74, service weight, hub-and-spigot coated soil pipe and fittings. Pipe shall be encased with 8 mil polyethylene sheeting installed in accordance with ANSI/AWWA C105/A21.5.
 - 1. Lead and Oakum Joints

2.03 ABOVEGROUND WATER PIPING

- A. Drawn Temper copper tubing: ASTM B88, Type L.
 - 1. Wrought-Copper fittings: ANSI B16.22, streamlined pattern.
 - 2. Solder Filler Material: Silver Brazing Alloy.
- B. Unions: ANSI B16.39, malleable iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads in unions shall conform to ANSI B1.20.1.
 - 1. Dielectric Unions: Threaded or soldered end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.
- C. Flexible Connectors: Stainless steel bellows with woven flexible bronze wire reinforcing protective jacket; minimum 150 psi working pressure, maximum 250 degrees F operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4 inch misalignment.

2.04 UNDERGROUND WATER PIPING

- A. Copper or Copper Alloy Tubing (Type K): ASTM B74, ASTM B88, ASTM B251.
- B. Ductile Iron Water Pipe (Cement Lined): AWWA C151, AWWA C115.

2.05 CONDENSATE PIPING

- A. Copper tubing, ASTM B88, Type L, Hard Drawn.
- B. Fitting: ASME B16.18, cast brass or ASME B16.22, wrought copper.
- C. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, braze, AWS A5.8, B cup silver/phosphorus/copper alloy with melting range 1190 degree Fahrenheit – 1480 degree Fahrenheit.
 - 1. Drainage piping specialties, cleanouts, drains and vandal-proof vent caps:
 - a. Josam Mfg. Co.
 - b. Knight Division, Koch Engineering Co.
 - c. Smith (Jay R) Mfg. Co.
 - d. Wade, Div. of Tyler Corp.
 - e. Zurn Industries Inc., Hydromechanics Div.
 - f. Approved Equal.

2.06 FITTINGS

- A. Dielectric Waterway Fittings:
 - 1. Victaulic Company of America
 - 2. Watts Regulator Co.
 - 3. Approved Equal.
- B. Dielectric Unions:
 - 1. Perfection Corp.
 - 2. Watts Regulator Co.
 - 3. Central Plastic Co.
 - 4. Approved Equal.
- C. Insulated Flanges:
 - 1. Central Plastic Co.
 - 2. Advance Products & Systems, Inc.
 - 3. Approved Equal.

2.07 VALVES

- A. General: Valves shall comply with ASME B31.9 for building service piping. Provide valves specified and indicated on the Drawings. Water working pressure rating for valves shall be less than hydrostatic test pressures for the system in which they are installed. In addition comply with manufacturer's Standardization Society of the Valves and Fittings Industry standards as follows.
 - 1. Cast Iron Gate Valves, SP-70
 - 2. Cast Iron Check Valves, SP-71
 - 3. Bronze Valves, SP-80

B. End Connections:

1. Threads: Comply with ANSI B2.1, steel pipe connection 2 inch and smaller.
2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves, steel pipe connection 2 1/2 inch and larger.
3. Solder Joint: Comply with ANSI B16.22, copper tube connection.
 - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 degrees F for gate, globe and check valves; below 421 degrees F for ball valves.
 - b. The use of filler material with lead content is prohibited.

C. Gate Valves:

1. Gate Valves - 2 inches and smaller: MSS SP-80; Class 125, body and bonnet of ASTM B 62 cast bronze, rising stem threaded ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel.
 - a. Stockham, B-109 or B-100
 - b. Nibco, S-111 or T-111
 - c. Milwaukee, 1149 or 148
 - d. Approved Equal.
2. Gate Valves - 2½ inch and larger: MSS SP-70; OS&Y, Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B, flanged ends, and "Teflon" impregnated packing and two-piece backing gland assembly.
 - a. Stockham, B-24 or B-22
 - b. Nibco, S-235 or T-235
 - c. Milwaukee, 1590T or 590T
 - d. Approved Equal.

D. Check Valves:

1. Swing Check Valves - 2 inch and smaller: MSS SP-80; Class 125, cast bronze body and cap conforming in ASTM B62, horizontal swing, Y-pattern, with bronze disc, and having threaded ends. Valve shall be capable of being reground while the valve remains in the line. Class 150 valves meeting the above specification may be used where pressure requires or Class 125 are not available.
 - a. Stockham, B-309 or B-319
 - b. Nibco, S-413-B or T-413-B
 - c. Milwaukee, 1509T or 509T
 - d. Approved Equal.

- E. Ball Valves:
1. Size 2½ inch and smaller: 400 lb. WOG, two piece cast bronze body, screwed ends, chrome plated brass ball, teflon ball and flange seals, rod silicon brass stem, teflon and Viton "O" ring stem seals, zinc plated carbon steel handle with vinyl grip and brass handle nut.
 - a. Apollo, 70-100/200
 - b. Stockham, S-216
 - c. Nibco, 580
 - d. Approved Equal.
- F. Drain Valves: ¾ inch brass, 150-lb. WSP, angle valves, fitted with ¾" brass hose nipple.
- a. Stockham B-229
 - b. Milwaukee
 - c. Nibco
 - d. Approved Equal.
- G. Mixing Valves (MV):
1. Thermostat mixing valve to comply with ASSE 1017. Manually adjustable. Bronze body. Union angle strainer check stops on inlets. Adjustable temperature setting locking regulator. Integral wall support. Cast lever handle, bronze finish. Minimum flow 1 GPM.
 2. Manufacturers:
 - a. Leonard Valve Co. Model TM-28.
 - b. Lawler Manufacturer Co.
 - c. Symmons Industries.
 - d. Approved Equal.
- H. Solenoid Valves (SV):
1. 2-way brass diaphragm valves:
 - a. Size: 1 ¼ inch to 1 inch.
 - b. Pressure range: 145 psi.
 - c. Temperature range: 14 degrees Fahrenheit to 140 degrees Fahrenheit.
 - d. Power: 6.5 watts at 24 VDC.
 - e. Body: Brass.
 - f. Seal: buna.
 - g. Other parts: stainless steel.
 - h. Coil: class F, molded, continuous duty and UL recognized.
 2. Manufacturers:
 - a. Kip Norgen Co. , Model 8241.
 - b. Dwyer.
 - c. Neptronic.
 - d. Approved Equal.

I. Freeze Protection Drain Valves (FPV):

1. Stainless steel body, fittings, spring and plug.
 - a. Maximum operating pressure: 300 psig.
 - b. Maximum operating temperature: 200 degrees F.
 - c. Full open temperature: 35 degrees F.
 - d. Full close temperature: 48 degrees F.
 - e. Brass Thermal Actuator
2. Manufacturers:
 - a. Therm-Omega-Tech, Inc., Model HAT/FP.
 - b. Danfoss.
 - c. Dwyer.
 - d. Approved Equal.

J. General Duty Valves:

1. Manufacturers:
 - a. Stockham
 - b. Nibco
 - c. Milwaukee
 - d. Crane
 - e. Approved Equal.

K. Relief Valves:

1. Manufacturers:
 - a. Conbraco Industries, Inc.
 - b. Watts Regulator Co.
 - c. Zurn Industries, Inc.; Wilkins-Regulator Div.
 - d. Approved Equal.

L. Two stage Electronic Thermostat (TF) for Freeze Protection:

1. On/Off control of valves:
 - a. Set point range: -30 degrees Fahrenheit to 220 degrees Fahrenheit.
 - b. Remote temperature sensing: up to 400 feet.
 - c. Input voltage: 120 VAC.
 - d. Switch action SPDT sensor 2 inches long x ¼ inch diameter with 8 feet cable.
2. Manufacturers:
 - a. Ranco Instrumentation, Model ETC.
 - b. Dayton.
 - c. Granger.
 - d. Approved Equal.

M. General Application: Use gate and ball for shut-off duty; ball valve for throttling duty.

2.08 HOSE BIBB WALL HYDRANT

- A. Non-Freeze Wall Hydrant (WH): Anti siphon automatic draining, non-freeze type wall hydrant incorporating integral backflow preventer approved by American Society of Sanitary Engineers (ASSE) and accepted by US Department of Health and listed by International Association of Plumbing and Mechanical Officials (IAPMO), with rough brass finish on brass casting, 3/4 inch hose thread nozzle. Operating stem to be hardened stainless steel. For concealed installations against vandalism, provide polished bronze box and hinged cover with loose "Tee" key to be furnished with each hydrant. Packing nut to be secured with locknut. Large hemispherical (compression type) permanent valve seat.

1. Manufacturers:
 - a. Zurn Z-1320-6.
 - b. Josam Series 71000.
 - c. Smith 5509QT.
 - d. Approved Equal.

2.09 FLOOR HYDRANT

- A. Provide hydrant with box for standard 3/4 inch hose end outlets. Hydrant of cast bronze box, hinged latching cover mechanism, adjustable locknut, removable nylon seat.

1. Manufacturers:
 - a. Josam Manufacturing Co., No. 7160.
 - b. Zurn Industries, Inc.
 - c. Wade.
 - d. Jay R. Smith Manufacturing Company No. 5611.

2.10 WATER PIPING ACCESSORIES

- A. Air Cushions: Fixtures and Tops of Risers: Each supply riser and fixture supply, including hot and cold water, shall have a separate air cushion chamber. At fixtures provide job-fabricated air cushions, consisting of a section of pipe not less than 12 inches long, and the same size to fixture, but not less than 3/4 inches.

- B. Backflow Preventers: Reduced Pressure Backflow Preventer (RPZ) shall comply with ASSE 1013 and AWWA C511 and consist of stainless steel internal parts and flange bolts and tight-sealing rubber check valve assemblies, suitable for 175 psi and 140 degree Fahrenheit temperature. Complete assembly includes supply strainer, ball valves before and after device and device composed of a pressure differential relief valve between two positive seating check valves and an intermediate atmospheric vent. Relief valve discharge piped to drain. Permission to use this is required by the City of Chicago.

1. Manufacturers:
 - a. Watt, Model 909s-QT.
 - b. Hersey Products.
 - c. Febco.
 - d. ITT.
 - e. Approved Equal.

- C. Thermometers: Thermometers shall be of the adjustable socket, mercury-in-glass, red-reading type with 9" Fahrenheit scale of proper range for the service, enclosed in metal, glass-covered case, with magnified mercury columns, separable wells, straight or angle mounted as required, and installed where indicated in piping systems in such a manner

as to be easily read. Provide extension necks where required to clear insulation.
Thermometers shall be provided where indicated.

1. Manufacturers:
 - a. Ashcroft
 - b. Terice
 - c. Weksler
 - d. Approved Equal.

D. Pressure Gauges: Pressure gauges shall be Grade A, accurate within 1%, of the Bourdon tube, spring type, with 4½" dials (unless otherwise indicated) and with recalibrating screws. Gauges shall have plain cases with screwed rings and be finished in black enamel. Each gauge shall be installed with necessary piping, including a shut-off cock. Provide pressure snubber on each gauge. Gauges shall not be installed until systems are cleaned.

1. Manufacturers:
 - a. Ashcroft "Quality"
 - b. Terice No. 600
 - c. Weksler "Regal"
 - d. Approved Equal.
2. Pressure gauge ranges shall be such that the portion of the pointer during normal operation will be 50% of dial range.
3. Pressure gauge shall be provided where indicated and as follows:
 - a. On each incoming cold water service main.
 - b. On discharge side of each pump.

2.11 WATER METERS

A. Coordinate supplying and installing water meters with "Water Systems" section of these specifications. Provide water meter assemblies with remote reading system as indicated and as required by the City of Chicago. Meters of nominal size 1-inch shall be of the rotating disc type which includes integral strainer housing. Assemblies shall include two isolating valves and union and nipples for meters with screwed end fittings.

1. Pressure Drop: Pressure drop across assembly shall not exceed ½ atmosphere, with the following rates of flow.
2. Register: Totalizing registers shall be of the following range: 1-1/2 to 3 inch size and 10 gallon total capacity with 100 gallons per sweep hand revolution.
3. Manufacturers (Size 3 inches and smaller):
 - a. Badger Meter, Inc.
 - b. Hersey, model HD Series.
 - c. Hedland flow meter.
 - d. Approved Equal.

2.12 DRAINAGE FITTINGS

A. General: Provide drainage fittings as indicated on the drawings and as hereinafter specified. Provide flashing flange with each drain and a clamping device where drain bodies pass through a waterproof membrane. Connection sizes of drainage fittings shall be as indicated in the drawings.

- B. Flashing Clamping Flanges: Provide cast iron clamping flange fittings with caulking ring on all piping where same pierces water proofing membrane:
1. Manufacturers:
 - a. Jay R. Smith #1760
 - b. Josam #26420
 - c. Zurn.
 - d. Approved Equal.
- C. Cleanouts (CO): Provide cast bronze, taper threads, counter sunk type cleanout plugs where shown on drawings and as required by Local Codes. Furnish access body assemblies for all cleanouts located in floors, and stainless steel shallow cover for all cleanouts located behind finished walls.
1. Cleanout Plugs: Cleanout Plugs shall be cast bronze taper thread countersunk type, complying with ANSI B2.1.
 - a. Manufacturers:
 - 1) Jay R. Smith, 4470
 - 2) Josam, 58540
 - 3) Zurn, ZARB-1470
 - 4) Approved Equal.
 2. Cleanouts - Threaded Seal - Finished Floors: Cleanouts with cast iron body and frame, flashing flange round adjustable scoriated nickel-bronze top and tapered thread bronze plug. Secured cover with vandal proof screws.
 - a. Manufacturers:
 - 1) Jay R. Smith, 4028-F-U-PB
 - 2) Josam, 56000-16-22-F
 - 3) Zurn
 - 4) Approved Equal.
 3. Cleanouts - Threaded Seal - Unfinished Floors: Cleanouts with cast iron body and frame, round adjustable scoriated cast iron top with non-tilt tractor cover and vandal proof screws.
 - a. Manufacturers:
 - 1) Jay R. Smith, 4248-U
 - 2) Josam, 56040
 - 3) Zurn, Z-1402-VP
 - 4) Approved Equal.
 4. Wall Cleanouts Finished Walls (WCO); Cleanouts with cast iron calk ferrule, cast bronze countersunk plug and stainless steel shallow cover with screw.
 - a. Manufacturers:
 - 1) Jay R. Smith, 4422
 - 2) Josam, 58710-15-22
 - 3) Zurn, ZN-1446-BP
 - 4) Approved Equal.

2.13 DRAIN COLLECTOR ASSEMBLIES

- A. General: Provide drain collector assemblies with cast iron bodies complete with flashing collar or device and hub or screwed bottom outlet, unless otherwise specified.
- B. Floor Drains: Provide floor drains, where shown on the Contract Drawings, of the size shown on the Contract Drawings and as follows:
1. Typical Floor Drains (FD-1): Coated cast iron body, nickel-bronze adjustable 5 inch round strainer head, sediment bracket, vandal-proof screw, flashing collar, 4" outlet, seepage flange and bottom caulk outlet.
 - a. Manufacturers:
 - 1) Jay R. Smith
 - 2) Josam
 - 3) Zurn
 - 4) Approved Equal.
 2. Toilet and Janitor Room Floor Drain (FD-2): Coated cast iron body, nickel-bronze adjustable 8 inch square strainer head with secured square hole grate, seepage flange and bottom caulk outlet.
 - a. Manufacturers:
 - 1) Jay R. Smith, 2010-B-U
 - 2) Josam, 30000-S-2-17
 - 3) Zurn, ZN-415-S-16-VP
 - 4) Approved Equal.
 3. Customer Assistance Kiosk - OSD-1 (open sight drain): 4" diameter galvanized cast iron funnel, with 2" P-trap.
 - a. Manufacturers:
 - 1) Jay R. Smith Figure 3822
 - 2) Approved Equal.
 4. Passageway Floor Drain (FD-3): Coated cast iron body, nickel bronze adjustable reinforced grate 8" square strainer, sediment bucket, vandal-proof screw and flashing collar:

- a. Manufacturers:
 - 1) Jay R. Smith 2010-K-B-U
 - 2) Zurn ZN-415-5-16-Y-VP
 - 3) Approved Equal.

- C. Roof Drains: Provide roof drains, where shown on the contract drawings of the size shown on the contract drawings and as follow:
 - 1. Roof Drain (RD-1) shall be cast iron body with combined flashing clamp and gravel stop, with polyethylene dome, extension, sump receiver and underdeck clamp.
 - a. Manufacturers:
 - 1) Jay R. Smith, 1010ERC
 - 2) Josam
 - 3) Zurn
 - 4)Approved Equal.

- D. Trench Drains: Provide trench drains where shown on the contract drawings, of the size shown on the contract drawings and as follows:
 - 1. Trench Drain (TD-1): Precast Polymer Concrete trench drain channel with 0.6% bottom slope. Trench width shall be 6 inches with a depth of 6.4 inches at the deep end and 6.2 inch at the shallow end. The length shall 39.19 inches. The grates shall be ductile iron slotted grate, securely locked down with built-in channel lock blocks. The channel shall have a vertical cutout for 4 inch discharge.
 - a. Manufacturers:
 - 1) Polydrain
 - 2) ACO Drain
 - 3) Approved Equal.

2.14 WATER HEATER

- A. Code and Standard Compliance:
 - 1. City of Chicago Building Code.
 - 2. Provide safety relief valves which comply with ASME Boiler and Pressure Vessel Code, and are stamped with appropriate code symbols.
 - 3. Provide water heaters with Performance Efficiencies not less than prescribed in ASHRAE 90A, "Energy Conservation in New Building Design".

- B. Electric water heater and tank:
 - 1. General: Provide commercial electric water heater with 6 gallon tank having 208V, 1 phase, 3 kw input and a recovery rate of 12 GPH at 100° F temperature rise.
 - 2. Heater: Construct for working pressure of 150 psi, magnesium anode rod, 3/4" tapping for relief valve, glass lining on internal surfaces exposed to water.
 - 3. Water heater shall be pre-wired and factory tested and be UL listed.
 - 4. Unit shall be equipped with immersion screw-in elements, surface mounted thermostat and automatic over temperature limit control.

5. Jacket: Insulate tank with vermin-proof glass fiber insulation, designed to meet the requirements of ASHRAE Standard 90.
6. Accessories: Provide $\frac{3}{4}$ " pressure and temperature relief valve.
7. Controls: Thermostat and temperature limit control. Agent on-duty/off-duty switch shall turn off water heaters when station is unoccupied by ticket agents.
8. Manufacturers:
 - a. Rheem Manufacturing Company - Model EGSP-6
 - b. Ebco Manufacturing Co.
 - c. Elkay Manufacturing Co.
 - d. Smith Corp. (A.O.); Consumer Products Div
 - e. State Industries, Inc.
 - f. White-Westinghouse
 - g. Approved Equal.

C. Water Heater Accessories:

1. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working pressure rating.
2. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater at full capacity.

2.15 PLUMBING FIXTURES

A. General:

1. The work shall comply with or exceed the references standards and codes.
2. All materials shall be clearly stamped or tagged as required by the referenced standards. Any materials or workmanship that does not meet the referenced standards and codes shall be discarded and replaced at the Contractor's expense.
3. Vitreous ware for the fixtures shall be first-quality, non-absorbent china, of even color and unwarped. Enamel ware shall be constructed of smooth, sound, iron castings, properly finished and provided with first-quality high-temperature enamel. Fittings for fixtures shall be of heavy red brass castings, properly finished and chrome plated. Escutcheons shall be of brass, sawtooth type. All exposed IPS piping and tubing shall be of red brass, chrome plated. Caulk all wall-hung fixtures between wall and fixture.

B. Plumbing Fixture Connections:

Where fixture connections are not sized, the following shall be the minimal nominal pipe size.

	SOIL OR WASTE	VENT	TRAP	COLD WATER	HOT WATER
Water Closet	4 in.	2 in.	4 in.	1-1/4 in. (Flush Valve)	
Lavatory	1-1/2 in.	1-1/2 in.	1-1/4 in.	1/2 in.	1/2 in.
Jan. Mop Basin/ Service Sink	3 in.	2 in.	3 in.	3/4 in.	3/4 in.
Electric Water Cooler	1-1/2 in.	2 in.	1-1/4 in.	1/2 in.	

C. Traps;

1. Each and every waste throughout shall be provided with a trap at or near the plumbing fixtures, unless otherwise specified. All traps shall be as specified in plumbing fixture specifications.

D. Couplings;

1. All pipes shall be joined to plumbing fixtures with screwed tail piece couplings and unions, or other outlet assemblies so that fixtures can be easily removed and reset.

E. Fixture Backing:

1. All wall hung plumbing fixtures not specified with chair carriers shall be supported on wall hangers furnished with the fixtures.
2. Steel reinforcing plates (minimum size inch thick by 3 inches of undrilled material past any drill hole) shall be installed behind wall in pipe space with carriage bolts installed through wall to support wall hanger and reinforcing plate.
3. Holes through wall shall be drilled, not punched.

2.16 LAVATORIES (LAV)

A. Rectangular-Wall Mounted:

1. Lavatory: Vitreous china 20"x18", mounted at handicapped height with rectangular basin, splash lip, front overflow, 8" centers and drilled for chair carrier with concealed arms:
 - a. American Standard, Lucern 0356.015
 - b. Crane Co.
 - c. Eljer Plumbing Co.
 - d. Kohler Co.
 - e. Approved Equal.
2. Faucet: 8" wide spread lavatory fitting 5" spout, 0.5 GPM flow restrictor spray outlet, color indexed wrist blade handles, slow-closing:
 - a. Chicago Faucet Co., No.404-VE2805CP.
 - b. American Standard
 - c. Delta Faucet Co.
 - d. Eljer Plumbingware Div.

- e. Kohler Co.
 - f. Approved Equal.
3. Strainer: Grid drain and 1¼" O.D. 18" tailpiece:
- a. American Standard
 - b. Kohler
 - c. Eljer
 - d. Approved Equal.
4. Trap: 1¼" cast brass adjustable P-trap with cleanout plug, tubing to wall and escutcheon:
- a. American Standard, 4402.012
 - b. Kohler, K-9000
 - c. Eljer
 - d. Approved Equal.
5. Supplies: Loose key angle stop, 3/8" IPS chrome plated inlets, ½" O.D. by 12 inches flexible risers and wall escutcheons:
- a. Chicago Faucet, No. 1005
 - b. Approved Equal.
6. Carrier: Floor mounted type with stub feet, concealed arms and chrome plated escutcheons, adjustable for handicapped height:
- a. Jay R. Smith
 - b. Josam
 - c. Zurn
 - d. Wade
 - e. Approved Equal.
7. Handicap lavatory P-trap and angle valve assembly shall be insulated with flexible vinyl insulation in accordance with ADA requirements:
- a. Truebro, Inc.
 - b. Brocar Products, Inc.
 - c. Plumberex Specialty Products
 - d. McGuire Manufacturing Co., Inc.
 - e. Approved Equal.

2.17 WATER CLOSETS (WC)

A. Wall-mounted with flushometer valve:

1. Low Consumption Toilet: Vitreous china elongated bowl, fully glazed trapway, siphon-jet, low consumption 1.6 gpf, meeting ADA accessibility standards, with 1½" top spud:
- a. American Standard, "Afwall" 3351.001
 - b. Crane Co.
 - c. Eljer Plumbing Co.
 - d. Kohler Co.
 - e. Approved Equal.

2. High Efficiency Toilet: Vitreous china elongated bowl, fully glazed trapway, siphon-jet, high efficiency 1.28 gpf, meeting ADA accessibility standards, with 1½" top spud:
 - a. American Standard, "Afwall" 3351.001
 - b. Crane Co.
 - c. Eljer Plumbing Co.
 - d. Kohler Co.
 - e. Approved Equal.

3. Toilet Seat: Extended white seat for elongated bowl, open front and stainless steel or chrome plated brass self-sustaining hinge with check:
 - a. Church, 295SSC
 - b. Clivus Multrum.
 - c. Beneke, 523SSCH
 - d. Olsonite, 10CCSS
 - e. Sperzel, 50-E w/CH
 - f. Approved Equal.

4. Carrier: Bolted type closet fitting with short feet, of sizes and types as required:
 - a. Josam Mfg. Co.
 - b. Jay R. Smith Co.
 - c. Wade, Division of Tyler Corp.
 - d. Zurn Industries, Inc.
 - e. Approved Equal.

5. Toilet shall be mounted at handicapped height with high rough-in for valve and high chair carrier. Nineteen inches (19") to top of seat to conform to ADA accessibility standards.

6. Flush valve: Quiet, exposed, diaphragm type, chrome plated water closet flushometer, low consumption (1.6 gpf max.) flush, ADA Compliant metal oscillation non-hold-open handle, 1" I.P.S. screw driver operated combination angle check and stop valve with protective cap, adjustable tailpiece, elevated vacuum breaker flush connection and spud coupling for 1½" top spud flanges:
 - a. Sloan Valve Co. "Royal" Model 115
 - b. Coyne & Delany Co.
 - c. Approved Equal.

7. Optional "Dual Flush" Flush valve (not to be used with 1.28 gpf toilet): Quiet, exposed, diaphragm type, chrome plated water closet flushometer, low consumption (1.1 gpf by lifting handle for a reduced flush or 1.6 gpf by pushing handle down for a full flush) dual flush, ADA Compliant metal oscillation non-hold- open handle, 1" I.P.S. screw driver operated combination angle check and stop valve with protective cap, adjustable tailpiece, elevated vacuum breaker flush connection and spud coupling for 1½" top spud flanges. Provide two (2) adhesive backed metal wall plates etched with instructions:
 - a. Sloan Valve Co. Model WES 111
 - b. Approved Equal.

2.18 URINAL (UR)

- A. Wall-mounted with flushometer valve:

1. High Efficiency Urinal: Vitreous china with flushing rim, siphon jet flush action, $\frac{3}{4}$ " inlet top spud, low consumption 1.9 Lpf/0.5 gpf, meeting ADA accessibility standards. Size approximately 14" x 14" x 21 $\frac{1}{2}$ ":
 - a. American Standard, "Allbrook" 6550.005
 - b. Crane Co.
 - c. Eljer Plumbing Co
 - d. Kohler Co.
 - e. Approved Equal.

- B. Flush valve for urinal: Quiet, exposed, diaphragm type, chrome plated water closet flushometer, low consumption (1.6 gpf max.) flush, ADA Compliant metal oscillation non-hold-open handle, 1" I.P.S. screw driver operated combination angle check and stop valve with protective cap, adjustable tailpiece, elevated vacuum breaker flush connection and spud coupling for 1 $\frac{1}{2}$ " top spud flanges:
 - a. Sloan Valve Co. "Royal" Model 115
 - b. Coyne & Delany Co.
 - c. Approved Equal.

2.19 MOP BASIN (MB)

- A. Mop Basin shall be precast terrazzo corner type, 24 inches by 24 inches by 12 inches, with 6 inches drop front and stainless steel cap on threshold, with 3 inch integral drain outlet and strainer.
 - a. Florestone Model 96
 - b. Fiat
 - c. Creative Industries
 - d. Standard Elsmere
 - e. Approved Equal.

- B. Mop Basin Faucet: Built-in service sink fitting with elevated vacuum breaker. Locate 7 foot 6 inches above finish floor per Chicago Code.
 - a. Chicago Faucet No. 911 1S
 - b. Approved Equal.

- C. Hose and Hose Bracket: Provide a 30" long flexible heavy duty 5/8" rubber hose, cloth reinforced, with 3/4" coupling at one end. Bracket shall be 18 ga, Type 302 stainless steel with rubber grip:
 - a. Fiat, #832-AA hose with bracket
 - b. Stern-Williams Co., Inc., #T-35
 - c. Approved Equal.

- D. Mop Hanger: Provide a 24" long by 3" wide, 18 ga. Type 302 stainless steel mop hanger with three (3) rubber tool grips:
 - a. Fiat, #889-CC
 - b. Florestone
 - c. Stern-Williams Co., Inc. #T-40
 - d. Approved Equal.

2.20 NOT USED

2.21 PIPE HANGERS AND SUPPORTS

- A. Provide adjustable hangers, inserts, brackets, rolls, clamps, supplementary steel, and other devices required for proper support of all pipe lines. Hangers shall be designed to allow for expansion and contraction of pipe lines, and shall be of adequate size to permit covering to run continuously through hangers. Piping at pumps, tanks, and other items of equipment shall be supported independently so that no weight shall be supported by the equipment.
- B. All non-copper hangers and supports, including rods which are not plated, shall be furnished with shop coat of rust inhibiting primer; copper or copper plated hangers and supports shall be used wherever they touch bare copper tubing.
- C. Wire or strap hangers are not permitted.
- D. Pipe supports for beam and joist construction shall be beam clamps, B-Line Fig. B3054.
- E. For insulated hot pipe and cold pipe in all sizes through 8", hangers shall be of Clevis type, B-Line Fig. B-3108, for non-insulated piping hangers shall be of Clevis Type B-3100.
- F. Piping supported from wall or columns shall utilize a steel bracket, B-Line Fig. 3-3064 with adjustable pipe roll and base, B-Line B-3121 and pipe covering protection saddle B-Line B-3160-3165.
- G. Cast iron stacks and galvanized risers shall be supported at each floor with friction clamps bolted together and supported by structural steel or additional channels, B-Line Fig. B-3373.
- H. Steel and cast iron pipe support spacing shall not exceed, and sizes of pipe-hanging suspension rods shall not be less than, the spacing and sizes indicated in the following tables.

1. Steel Pipe:

Nominal Pipe Size	Maximum Span	Minimum Rod Diameter
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	7'	3/8"
1 1/4"	8'	3/8"
1 1/2"	9'	3/8"
2" and 2 1/2"	10'	3/8"
3"	12'	1/2"
4"	12'	5/8"
5"	12'	3/4"
6"	12'	3/4"
8" to 12"	15'	7/8"

2. Copper Pipe:

Nominal Tube Size	Maximum Space Between Hangers	Minimum Rod Diameter
Up to 1"	5'	3/8"
1 1/2" to 2"	6'	3/8"
2 1/2"	9'	1/2"

3"	10'	1/2"
4"	12'	5/8"

- I. Maximum distance for cast iron piping shall be 10 feet, 0 inches with all hub supported and with a minimum of _ inch rod diameter.

2.22 PIPE SLEEVES AND ESCUTCHEONS

- A. Provide pipe sleeves for all pipes which pass through walls, partitions, floors, ceilings, or roofs.
- B. General floor sleeves shall be standard weight galvanized steel pipe with bottom end flush with surface, top end extend 1" above finished floor, caulked.
- C. Foundation walls and slabs on grade: Cast iron (per Clow 1430/1435 or Josam, Zurn, J.R. Smith or Wade), sleeves, flush inside and outside, integral waterstop, caulked, or Thunderline linkseal series "LS" sleeve with waterstop, rubber sealing elements, pressure plates and bolts.
- D. Concrete walls: Standard weight galvanized steel pipe, flush with wall surface at both ends anchored and caulked.
- E. Sleeves through fire/smoke rated walls or floors shall be of standard weight galvanized steel pipe.
- F. Interior partitions and ceilings: 20 gauge galvanized steel with lock joints.
- G. Sleeves for uninsulated piping shall be two (2) sizes larger than pipe passing through. Sleeves for insulated piping shall be large enough to accommodate the full thickness of the pipe covering with clearance for expansion and contraction.
- H. Where pipes pass through floors on fill or concrete exterior walls, caulk sleeves with oakum and lead wool.
- I. For all fire rated walls, and partitions, annular space between interior surface of all pipes and sleeves shall be packed with fire rated material such as Johns-Manville "Cerafiber", Super 48 Insulating Cement or Thermo-Fiber #CW40 and caulked water-tight with a water-proof mastic such as Ink-Smith B-1 butyl sealant, or approved equal.
- J. Pipe sleeves through non-rated wall, floors and partitions shall have the openings packed with glass fiber insulation and both ends of sleeves caulked with waterproof mastic.
- K. Escutcheons:
 - 1. Provide escutcheons on all exposed piping passing through walls, floors, partitions and ceilings.
 - 2. Escutcheons shall be held in place by internal spring tension or set screws.
 - 3. Application:

<u>Location</u>	<u>Escutcheon Material</u>
Finished Spaces:	Anodized aluminum, chrome plated brass or stainless steel.
Unfinished Spaces: Excluding mechanical equipment rooms.	Plain brass, or aluminum

- L. Roof flashing assemblies: Manufactured assembly made of 6 lb per sq. ft., 0.09 inch thick, lead flashing collar and skirt extending at least 8 inches from pipes with galvanized steel boot reinforcement, and counter flashing fitting.

2.23 REDUCED PRESSURE BACKFLOW PREVENTER

- A. Threaded type bronze construction, stainless steel internal parts and flange bolts, and tight-sealing rubber check valve assemblies. Suitable for supply to 175 psi and 140 degrees F. temperature. Complete assembly includes supply strainer, ball valves before and after the device and the device composed of a pressure differential relief valve between two positive seating check valves and an intermediate atmospheric vent. Relief valve discharge piped to drain. Backflow preventer approved under ASSE Standard 1013. Permission to use this is required by the City.

1. Watts Regulator Company, No. 909S-QT.
2. Hersey Products, Inc.
3. ITT Lawler.”

PART 3 EXECUTION

3.01 GENERAL

- A. Provide and install all piping, fittings, equipment, fixtures, and accessories, as shown on the Contract Drawings, as required by the referenced standards and codes, as recommended by the manufacturer, and as specified for water, drainage, waste and vent systems.
- B. All piping shall be arranged and aligned in accordance with reviewed Shop Drawings. Install all piping straight and direct as possible, neatly spaced with risers and drops running plumb and true.
- C. Installation of piping shall be coordinated with other work. The Contractor shall carefully check the architectural, mechanical, structural, electrical and civil drawings for conflicts and interferences with his/her work.

3.02 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for plumbing fixtures and other equipment have water and drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- E. Do not proceed until unsatisfactory conditions have been corrected.

3.03 GENERAL PIPING INSTALLATION

- A. Full lengths of pipe shall be used wherever possible. Short lengths of pipe with couplings will not be permitted.
- B. All pipe shall be cut to exact measurement to be installed without forcing. After cutting, ends shall be reamed and cleaned to eliminate foreign matter and burrs.
- C. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted.
- D. All pipe and fittings shall be marked by the manufacturer in accordance with the marking sections of the standards to which reference is made or in accordance with the requirements of MSS-S-5: Standard Marking System for Valves, fittings, Flanges and Unions of the Manufacturers Standardization Society of the Valve and Fittings Industry.
- E. Make all changes in size and direction of piping with manufactured fittings. Field fabricated fittings will not be allowed.
- F. Joints in threaded pipe installations shall be made tight without caulking or the use of lead or paint, and no lubricant shall be used except flake graphite and cylinder oil paste; Dixon's Compound or Key Paste, and the lubricant shall be applied to make threads only.
- G. Pipe sizes for all branches, stubs, etc., shall have a minimum size of $\frac{3}{4}$ inch.
- H. In screwed pipe installations, the use of short lengths of pipe and couplings shall not be permitted. Piping between fittings shall be continuous wherever possible. If, however, the distance between fittings exceeds the normal random length of pipe, and couplings shall be used, they shall be heavy recessed couplings of the same material as the pipe to which they are attached.
- I. Final connections to equipment $2\frac{1}{2}$ inches and larger shall be flanged. Connections 2 inches and smaller shall be made with screwed unions or union fittings. It is the responsibility of the Contractor to provide flanged outlets on equipment connections $2\frac{1}{2}$ inches and larger.
- J. In screwed pipe installations, provide a union at each screwed valve, strainer, etc., and elsewhere as indicated on the drawings or wherever required for proper servicing of equipment, accessibility, etc.
- K. The use of close or short screwed pipe nipples shall be avoided wherever possible; however, if roughing-in dictates the use of close or short nipples, they shall be of pipe the same material as adjoining pipe.
- L. Wherever two or more pipes are to be installed in parallel, or parallel to the piping of other trades, the piping shall be installed with sufficient space between pipes to allow for the proper application of pipe covering, painting and/or servicing.
- M. In no case shall any pipe be installed where it is supported on, or suspended from, another pipe or the piping of other trades.
- N. When necessary to fit or center with windows and door openings, Contractor shall, at his/her expense, shift and relocate outlets, roughing-in, etc., as directed by the Authority.
- O. All piping subject to expansion and contraction, at the time of installation, shall be cold sprung to allow in part for expansion.

- P. In all cases where pipe connections are made to piping or any item of equipment of dissimilar metal, provide the proper type of dielectric fitting; EPCO or Center Plastics insulated unions.

3.04 INTERIOR SUSPENDED PIPE INSTALLATION - DRAINAGE AND VENT SYSTEM

- A. Horizontal drain runs shall be installed at a pitch not less than 1/8" to the foot, shall be suspended with hangers. All changes in direction of suspended soil and waste piping shall be made with long-sweep drainage fittings. All offsets shall be made with 45° fittings, except as otherwise noted. Due allowance for expansion shall be made in all lines.
- B. Traps shall be furnished and installed to connect each fixture or piece of equipment not having a trap or seal as an integral part of same into sewer system. They shall conform to the following patterns and materials:
1. Recessed threaded cast iron drainage traps, where shown or required, shall be installed when connections are made in steel pipe.
 2. Bell-and-spigot cast iron drainage traps shall be installed when connection are made in bell-and-spigot pipe.
 3. All exposed traps for fixtures shall be cast-brass, chrome-plated.
 4. All traps installed in accessible positions shall be fitted with cleanout plugs or with other acceptable means of cleaning.
- C. Vent piping shall run parallel to the drainage systems, venting all traps on fixtures, and connecting to the main stacks, which shall be extended through the roofs. Extra-heavy cast iron increasers shall be installed on the top of each soil and vent stack before the same passes through the roof. These increasers shall be one pipe size larger than the soil and vent stacks, with no roof increaser smaller than 4". Soil and vent stacks shall extend at least 12" square, extended up and 3" down into tops of increasers. All horizontal vent pipes shall be grade up to meet the requirements of local and State codes.
- D. Provide cleanouts at each 90° change of direction in suspended horizontal soil or waste pipe, 50' intervals in straight runs, at the base of each downspout and stack, in all P-traps not installed in ground, and at such other points as may be necessary for proper cleaning. Provide flashing flange with each cleanout and a clamping device where cleanouts pass through a waterproof membrane.

3.05 SUSPENDED PIPING INSTALLATION - WATER DISTRIBUTION

- A. General: All piping shall include the following:
1. Isolation valves and unions or flanges at each branch, and in supply and return to each item of equipment such as pumps, tanks, automatic valves etcetera. Valves and unions or flanges shall be located to isolate each unit, branch, or section of piping to facilitate maintenance and/or removal of all equipment.
 2. Gate valves on capped services for extension to equipment furnished under other sections.
 3. Drain valves at all low points of each system to enable complete drainage.
 4. Drain piping from pump glands, relief and safety valves, etc., to spill over open sight drains, floor drains, or other acceptable discharge points, terminating drain line with plain end (unthreaded) pipe.
 5. Horizontal water supply and return piping, with straight side of eccentric fittings at top of pipe, and pitch upward 1" in 40' in direction of flow.

3.06 LOCATION OF OPERATION AND MAINTENANCE SYSTEM COMPONENTS

- A. System components which require observation, operation or maintenance - such as valves, traps, gauges, controls, strainers, dirt pockets, cleanouts, unions and flanges, etc.- shall be located whenever possible so as to be readily accessible. They shall not be concealed in chases or above ceilings without provision for access.
- B. Install all valves with stems in either an upright (preferred) or horizontal position. Control valves shall be installed with top works upward unless specifically shown otherwise.
- C. Instruments (i.e. pressure gauges, thermometers, orifice plates, etc.) are shown on the drawings in their approximate locations. Exact locations shall consider visibility and any special installation requirements.

3.07 INSTALLATION OF VALVES

- A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inch and smaller, use gate or ball valves.
- B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2 inch or smaller, use gate or ball valves.
- C. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system.

3.08 WATER HEATER INSTALLATION

- A. General: Follow manufacturer's recommendations for the installation, commissioning, adjusting, operation, and maintenance of electric water heaters.
- B. Install water heater on wall bracket as shown on drawings or required. Set and connect units in accordance with manufacturer's written installation instructions. Install units plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances. Orient so controls and devices needing servicing are accessible.
- C. Install thermometers on water heater inlet and outlet piping.
- D. Install combination temperature and pressure relief valves in water piping for water heater. Extend commercial water heater relief valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

3.09 WATER HEATER CONNECTIONS

- A. Piping installation requirements are specified in other sections. The drawings indicate general arrangements of piping, fittings, and specialties. The following are specific requirements:
 - 1. Install piping adjacent to equipment arranged to allow servicing and maintenance. Allow for easy removal of water heaters.
 - 2. Connect hot and cold water piping to units with shutoff valves and unions. Connect hot water circulation piping to unit with shutoff valve, check valve, and union.
 - a. Where heater-piping connections are dissimilar metals, make connections with dielectric fittings or dielectric unions specified in the section, "Basic Piping Materials and Methods".
 - b. Provide 6 inch minimum heat trap in hot water as per City of Chicago Energy Code.
 - 3. Install drain as indirect waste to spill into open drain or over floor drain. Install drain valve at low point in water piping for water heaters not having tank drain.
- B. Connect wiring according to code and electrical requirements in electrical sections of these specifications. All equipment shall be grounded.

3.10 COMMISSIONING OF WATER HEATERS

- A. Perform the following before start-up final checks:
 - 1. Operational Test: After electrical circuitry has been energized and water has been turned on, confirm proper operation.
 - 2. Check for piping connections leaks.
 - 3. Test operation of safety controls and devices.
- B. Perform the following start-up procedures:
 - 1. Adjust operating controls.
 - 2. Adjust hot water outlet temperature setting.

- C. Replace water heaters or components of water heaters that do not function properly or are defective.

3.11 PLUMBING FIXTURE INSTALLATION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine all rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Do not proceed until satisfactory conditions have been corrected.
- E. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and referenced standards.
- F. Comply with the installation requirements of ANSI A117.1 with respect to plumbing fixtures for the physically handicapped.
- G. Fasten plumbing fixtures securely to supports of building structure. Secure supplies behind wall construction to provide rigid installation.
- H. Set mop receptors in a leveling bed of cement grout.
- I. Install a stop valve in an accessible location in the water connection to each fixture.
- J. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- K. Protect finishes of china and porcelain fixtures from scratches, chips, stains or other damage. Protect metal finishes of water coolers, faucet assemblies, and other finished metal. Protect mop basins from scratches, chips, and stains.

3.12 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Do not enclose, cover, or put into operation water, drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection shall be made. Perform tests specified by the City of Chicago Building Code in the presence of the plumbing official.
 - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. Reinspection: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Test water distribution piping as follows:
1. Test for leaks and defects all water distribution piping systems. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 2. Leave uncovered and unconcealed all water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
 3. Cap and subject the piping system to a static water pressure of 1 1/2 times the design pressure but not less than 100 psi without exceeding the pressure rating of piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
 4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
 5. Prepare all reports for all tests and required corrective action.
- C. Test drainage system as follows:
1. Test for leaks and defects all drainage and vent piping systems. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 2. Leave uncovered and unconcealed all drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
 3. Rough Plumbing Test Procedure: Except for outside leaders, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
 4. Finished Plumbing Test Procedures: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack opening on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
 5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
 6. Prepare reports for all tests and required corrective action.

3.13 ADJUSTING AND CLEANING

- A. Clean and Disinfect water distribution piping as follows:
1. Purge all water distribution piping systems.
 2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:

- a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
- b. Fill the system or part thereof, with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
- c. Drain system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
- d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.
- e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

3. Prepare reports for all purging and disinfecting activities.

- B. Adjust water pressure at fixtures to provide proper flow and stream.
- C. Clean fixtures, trim, and strainers using manufacturer's specified cleaning methods and materials. Protect exposed metal finishes against damage from strong cleaning solutions.
- D. Clean interior of piping system. Remove dirt and debris as work progresses.

3.14 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- C. Provide protective covering for installed fixtures, electric water coolers, and trim.
- D. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Authority.

3.15 HEAT TRACING

- A. All water, waste and vent piping exposed to the cold weather shall be heat-traced as indicated on the Drawings.
- B. All heat traced piping shall be insulated and provided with a weatherproof jacket to protect the insulation.

3.16 CORROSION CONTROL

- A. All metallic piping passing from within the structure into the ground shall be fitted with two stage dielectric isolation couplings to prevent possible stray currents.

END OF SECTION 22 40 00

SECTION 22 40 10
PREFABRICATED TRENCH DRAIN SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, material, equipment, and services necessary to furnish and install a prefabricated trench drain system at the locations shown on the Drawings, as specified herein, or as otherwise required.
- B. The plumbing work includes but is not limited to the following:
 - 1. Prefabricated trench drain system matching existing, including excavation, concrete base, drainage channel sections, grating.
 - 2. Connections to existing sewer.
 - 3. Plumbing permits.
 - 4. Testing.
 - 5. Other accessories and related work.

1.02 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.
- B. Related Sections:
 - 1. Division 03 Sections, Cast in Place Concrete.
 - 2. Division 22 Sections, Plumbing.
 - 3. Division 31 Sections, Earthwork.

1.03 SUBMITTALS

- A. The Contractor shall furnish for the Authority's review and approval shop drawings in accordance with the requirements of Division One Section, Submittals, and as required below:
 - 1. Shop Drawings of trench drain layout in plan.
 - 2. Details and section of trench drain assembly and installation.
 - 3. Details for connection of trench drains to existing sewer.
- B. The Contractor shall furnish for the Authority's review and approval product data, manufacturer's literature, specifications, catalog cuts, installation instructions and dimensions, materials, accessories and guarantees for the following:
 - 1. Trench Drains.
 - 2. Trench Drain Covers.
 - 3. Piping and fittings.
- C. The Contractor shall furnish for the Authority's review and approval samples for the following:
 - 1. Trench Drains.
 - 2. Trench Drain Covers.
- D. Test and Inspection Reports: Furnish within five (5) days of each test or inspection of any piping segment, equipment device, or system. Include all relevant information concerning

the test or inspection, as provided in the format specified, including Contractor's Material and Test Certificates for the following item:

1. Leak testing of trench drain system.
2. Pressure Testing of piping connections.

1.05 QUALITY ASSURANCE

- A. General: All materials shall be clearly stamped or tagged as required by the referenced standards. Any materials or workmanship which in the opinion of the Authority does not use the referenced standards and codes shall be discarded and replaced at the Contractor's expense.
- B. Authority's Review: No portion of any work shall commence until review of shop drawings or submittals for that portion of work has been completed and returned to the Contractor. All work shall be in accordance with and constructed from documents bearing the Authority's stamp of review.
- C. Manufacturer Qualifications: Subject to conformance with the requirements of the Contract Documents, the Contractor shall furnish plumbing materials manufactured by a company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.
- D. Installer Qualifications: Subject to conformance with the requirements of the Contract Documents, plumbing shall be installed by a company specializing in performing the work of the Section with minimum five (5) years documented experience.
- E. Regulator Requirements: City of Chicago Plumbing Code.
- F. Provide certification indicating that trench drain system is capable of sustaining the loadings to the specified load class.

1.06 REFERENCES

- A. General: The work shall comply with or exceed the referenced standards and codes. Any work which cannot meet the referenced standards and codes shall be brought to the attention of the Authority for his/her written approval before proceeding with the work.
- B. Codes: The work shall comply with the following codes:
 1. City of Chicago Plumbing Code
 2. State of Illinois Plumbing Code
- C. Standards: The work shall comply with the following standards.
 1. American Society of Mechanical Engineers (ASME)
 - a. ASME/ANSI Sec. 9 - Welding and Brazing Qualifications
 - b. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
 - c. ASME/ANSI B16.3 - Galvanized Malleable Iron Threaded Fittings
 - d. ASME/ANSI B16.4 - Cast Iron Threaded Fittings Class 125 and 250
 - e. ASME/ANSI B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings
 - f. ASME/ANSI B16.12 - Cast Iron Threaded Drainage Fittings
 - g. ASME/ANSI B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
 - h. ASME/ANSI B16.26 - Cast Bronze Fittings for Flared Copper Tubes

- i. ASME/ANSI B16.39 - Malleable Iron Threaded Pipe Unions
- j. ASME/ANSI B31.9 - Building Service Piping

2. American Society of Testing and Materials (ASTM)

- a. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
- b. ASTM A74 - Cast Iron Soil Pipe and Fittings
- c. ASTM B88 - Seamless Copper Water Tube
- d. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube

- D. Conflicts: In all cases where conflicts exist in standards or codes, the more stringent requirement shall be followed. Where the Contract Documents are in excess of the referenced codes and standards, the Contract Documents shall be followed. All conflicts shall be brought to the attention of the Authority for his/her written approval before proceeding with the work in question.

1.07 SEQUENCING/SCHEDULING

- A. The Contractor shall schedule and perform tasks required for furnishing and installing the plumbing in conformance with the requirements of the accepted project schedule.
- B. Coordinate the size, location, depth, slope and connections of the trench drain system with the excavation work, other plumbing work, concrete work and other construction.
- C. Coordinate the installation of plumbing in poured-in-place concrete slabs, provide for proper drain elevations, and slope to drains.
- D. Coordinate the installation of sewer systems as necessary to interface trench drains with drainage piping systems.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.09 WARRANTY

- A. Provide a minimum one year warranty from the date of final acceptance for all materials and workmanship for the prefabricated trench drain system signed by both the manufacturer and installer of the system. Repairs or replacements required due to faulty materials or workmanship shall be at no cost to the Authority.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plumbing, piping, equipment and fixtures which may be incorporated in the work included, but are not limited to, the following:
1. Prefabricated Trench Drain System: ACO Power Drain S100K as manufactured by ACO Polymer Products, Inc. or an equal product submitted for review and approved by the Authority.

2.02 TRENCH DRAIN SYSTEM

- A. Heavy duty type designed for industrial applications. System to be able to withstand the traffic and loadings that would be encountered in the rail car repair facility.
1. The channel system shall be independently certified to withstand loadings to load class F.
- B. Drain to be 4.00" wide internally and 6.3" overall with continuously sloped bottom. Units shall have a wall thickness of at least 0.67".
- C. Drain body to be formed of polymer concrete, a material made from polyester resin binder reinforced by mineral aggregates and filler.
- D. Units shall have horizontal cast in anchoring features on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface.
- E. Units shall have a male to female interconnecting end profile.
- F. Minimum properties of polymer concrete:
1. Compressive strength: 14,000 psi
 2. Flexural strength: 3,600 psi
 3. Water absorption: 0.1%
 4. Polymer concrete material to be frost proof, salt proof and dilute acid and alkali resistant.

2.03 TRENCH DRAIN GRATES

- A. Grates to be of heavy duty slotted ductile iron. Grates to sit on ductile iron edge rails integrally cast in the channel body. Edge rail to be a minimum of ¼" thick. Installation to allow for absorbing impact loads. Grates to be flush with the adjacent floor surface. Grates to be removable for access to the trench for maintenance but also be secured into place to prevent longitudinal movement.
- B. Ductile iron to be ASTM 536-84 – Grade 65-45-12.
- C. Anchors to be stainless steel.

2.04 DRAIN OUTLET

- A. Bottom outlets to be 4" round.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide and install trench drain system as shown on the drawings and as required for a functional system.
- B. All piping shall be arranged and aligned in accordance with reviewed Shop Drawings. Install all piping straight and direct as possible, neatly spaced and running plumb and true.
- C. Installation and connection of the trench drain system and related piping shall be coordinated with other work. The Contractor shall coordinate the trench drain work with the other plumbing, structural, architectural and other work. Work shall be reviewed for conflicts and interferences.

3.02 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for trench drain units and other equipment have drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls and floors pit for suitable conditions where drain units and specialties are to be installed.
- E. Do not proceed until unsatisfactory conditions have been corrected.

3.03 GENERAL INSTALLATION

- A. Install prefabricated trench drain system according to manufacturer's recommendations and instructions.

3.04 PREPARATION

- A. Provide and install concrete surround for setting prefabricated trench drain system. Verify with manufacturer of trench drain units, approved shop drawings and field conditions and dimensions for size, depth and location for excavation and concrete installation. See details. Concrete surround to be 4" – 6" thick all around of 3000 psi minimum strength concrete. The finished high level of the concrete surround must be approximately 1/8" above the top of the channel edge. Slope the top of the concrete to the drain. Provide a 1/2" expansion joint between concrete surround for trench drain and adjacent concrete floor slab.
- B. Provide solid and dry base and excavation under the concrete. Excavation shall be at proper elevation and of proper size to allow for installation of the concrete surround for the trench drain and for the trench drain system.
- C. Provide access for sewer connections for trench drain.

3.05 INSTALLATION OF TRENCH DRAIN UNITS

- A. Full lengths of trench drain units shall be used wherever possible. Short lengths will not be permitted.
- B. When required, units shall be cut and finished according to manufacturer's instructions.
- C. Cutting or other weakening of the building structure to facilitate the installation of the trench drain system will not be permitted.
- D. Male to female joints at the drain body units shall be made tight. Provide and install sealant as recommended.
- E. Make connections between trench drain assembly and sewer as required and per code.

3.06 INSTALLATION OF GRATE

- A. Install grate and secure into place. Cut and adjust as required and according to manufacturer's recommendations.
- B. Top of grate to be flush with the metal edge and edge of the concrete surround. Avoid any tripping hazards.

3.07 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Do not enclose, cover, or put into operation drainage system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection shall be made. Perform tests specified by the City of Chicago Building Code in the presence of the plumbing official.
 - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
 - 3. Reinspection: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
 - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Test drainage system as follows:
 - 1. Test for leaks and defects all drainage and vent piping systems. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave uncovered and unconcealed all drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
 - 3. Rough Plumbing Test Procedure: Except for outside leaders, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through

- completion of the inspection. Inspect all joints for leaks.
4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
 5. Prepare reports for all tests and required corrective action.

3.08 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

END OF SECTION 22 40 10

SECTION 23 00 00
HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, material, equipment, and services necessary to furnish Heating, Ventilating and Air Conditioning Systems at the location(s) shown on the Drawings and/or as specified herein.

1.02 RELATED WORK

- A. Mechanical Insulation, Section 23 07 00.

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. The American Society of Heating, Refrigeration Air Conditioning Engineers Guides (ASHRAE).
2. Sheet Metal and Air Conditioning Contractors' National Association, Inc. SMACNA "HVAC Duct Construction Standards, Metal and Flexible", and SMACNA, "Manual for the Balancing and Adjusting of Air Distribution Systems".
3. The Underwriters' Laboratories (UL) listings or approvals shall govern quality and performance of the electrical products specified herein.
4. American National Standards Institute (ANSI) B31.5 Refrigeration Piping.
5. Chicago Electrical Code, latest edition.
6. American Society for Testing and Materials:
 - a. ASTM A36, Structural Steel.
 - b. ASTM A527, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-forming Quality.
 - c. ASTM B209 Aluminum-Alloy Sheet and Plate.
 - d. ASTM B32, Soldered Joints
7. Federal Specifications:
 - a. FF-B-588C, Bolts, Toggle, and Expansion Sleeve (Screw).
 - b. FF-S-107C(2), Screws, Tapping and Drive.
 - c. FF-S-325, Shield, Expansion; Nail, Expansion and Nail Drive Screw (Devices, Anchoring, Masonry).
8. National Fire Protection Association:
 - a. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - b. NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
 - c. NFPA 255, Method of Test of Surface Burning Characteristics of Building Materials.
9. American Society of Mechanical Engineers (ASME).
10. National Electric Manufacturer's Association (NEMA).
11. AMCA Compliance, Test and rate air handling units in accordance with AMCA standards.

12. ARI Compliance, Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air handling Units", display certification symbol on units of certified models.
13. ASHRAE Compliance, Construct and install refrigerant coils in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
14. UL and NEMA Compliance, Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.
15. NEC Compliance, Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.
16. City of Chicago Building Code.
17. American Welding Society (AWS).

1.04 SUBMITTALS

- A. The Contractor shall furnish shop drawings, product data and samples in accordance with the requirements of Section 00830-Special Conditions, and as required below:
 1. Shop Drawings/Product Data:
 - a. Ductwork Layout & Details.
 - b. Ductwork Accessories.
 - c. Grilles, Registers, Diffusers, Gravity & Counter Balanced Dampers and Louvers.
 - d. Fans.
 - e. Duct-Free Split Fan Coil and Air Cooled Condensing Units. (Including VRF Products)
 - f. Forced Air Wall Heaters
 - g. Air Filters
 - h. Infrared Heaters.
 - i. Automatic Damper electric operators.
 - j. Refrigerant and Condensate Piping.
 - k. Piping and Duct Insulations.
 - l. Controls.
 - m. Thermostats.
 2. The Contractor shall furnish operating instructions and maintenance recommendations/requirements in accordance with the requirements of Section 00830-Special Conditions, and as required below:
 - a. Operation Instructions.
 - b. Manufacturer's Catalog Sheets.
 - c. System Line Diagrams.
 - d. Panel Layout Drawings.
 3. Certificates:
 - a. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ANSI B31.5).
 - b. Welding Certification: Certify welding procedures, welders, and operators are in accordance with ASME and AWS Standards.
 - c. Americo.

1.05 SEQUENCING/SCHEDULING

- A. The Contractor shall schedule and perform tasks required for furnishing and installing the Heating, Ventilating and Air Conditioning Systems in conformance with the requirements of the accepted project schedule.

PART 2 PRODUCTS

2.01 SHEET METAL STANDARDS

- A. Iron and Steel Sheets (Galvanized): Lock forming quality (LFQ) with 1-1/4 oz. (36 g) galvanizing total on both sides per sq. ft. (0.09 sq.m) of sheet.

2.02 DUCTWORK MATERIALS

- A. General: The thickness of the sheet metal and size and spacing of the stiffeners used shall be in accordance with the requirements of the latest edition of the SMACNA, "HVAC Duct Construction Standards, Metal and Flexible". "Low Velocity Duct Construction Standards."
 - 1. Low Pressure (Up to 2" S.P. (0.5 kPa) Ductwork: Construct in accordance with the requirements of the SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
- B. Material: Galvanized sheet steel unless otherwise specified.
- C. Duct Sealant: All joints and seams in supply ductwork shall be sealed with fire resistive duct sealer. Sealer shall be buttered on seams and joints during fabrication and erection.
- D. Acceptable Manufacturers:
 - 1. Minnesota Mining and Manufacturing Co., Duct Sealer EC800.
 - 2. Benjamin Foster, 30-02 Fire Resistive Duct Sealer.
 - 3. United Sheet Metal, United Duct Sealer.
- E. Connections and Details: Connections to diffusers, grille and register faces shall be absolutely airtight. All slip joints shall be made in the direction of flow, and unless otherwise indicated on the drawings, all radius elbows shall have a centerline radius equal to 1-1/2 times the width of the duct.
- F. Rectangular Ductwork: Groove and Pittsburgh lock seams and slip joints shall be used for all rectangular ducts unless otherwise specified.

2.03 FLEXIBLE CONNECTIONS

- A. General: Flexible fabric connections to prevent the transmission of vibration through the ducts shall be UL classified and shall be installed on both the supply and return sides of all fans and ventilating units and at building expansion joints, and approximately where shown on the drawings. Fabric used for flexible connections shall be of proper weight and strength for the service required, and shall be properly fitted to render it airtight. Fabric shall be of sufficient width to provide a minimum space of 4" (10 cm) between connected items, and with sufficient slack to prevent tearing due to fan movement.
- B. Fabric - General Usage: 30-oz. (0.8 kg) fiber glass fabric, fire retardant and airtight, coated with neoprene on both sides, and with firmly attached extra wide galvanized metal edges.
- C. Acceptable Manufacturers:

1. Ventfabric Inc., Ventglas.
2. Elgen, Neoprene Fabriduct.

2.04 GRILLES, REGISTERS, DIFFUSERS, GRAVITY DAMPERS, COUNTER BALANCED DAMPERS AND LOUVERS

- A. General: Grilles, registers and diffusers shall be of the sizes indicated, with white finish coat unless otherwise specified, and shall be supplied with gaskets to prevent air leakage around side of units. Screw holes in frames shall be countersunk for flat head screws.
- B. Exhaust Registers: Single deflection type with 3/4" blade spacing; horizontal 35⁰ degree face bars and opposed blade dampers.
- C. Supply Registers: Fully adjustable discharge pattern, 4-way pattern with opposed blade dampers.
- D. Acceptable Manufacturers:
 1. Titus
 2. Metal Aire
 3. Carnes
 4. Krueger
- E. Dampers shall be heavy duty Ruskin, Air Warming or Penn backdraft dampers or approved equal with counterbalancing as required. Frame shall be of .081" thick extruded aluminum and damper blades shall be .070" minimum thickness extruded aluminum.
- F. Louvers shall be sized per drawings to fit in wall opening and be 4" and 6" deep as shown on the drawings, stainless steel with insect screen. Provide a stormproof design. Acceptable manufacturers include Penn, Airstream, Ruskin, Vent Products or approved equal.

2.05 FANS, GENERAL

- A. Factory-built Units: Fans in Factory-Built Units shall be unit manufacturer's standard type, unless otherwise specifically indicated.
- B. Identification: All fans shall bear metal identification plates indicating area served, CFM, H.P. watts, RPM, SP, and size. Fan capacities shall be based on operating at the static pressures indicated at 70 degree F and 29.92" of mercury, barometric pressure. Fans shall bear the AMCA label.

2.06 EXHAUST FANS

- A. Furnish and install where noted on the drawings propeller blower type exhausters. Ventilator housings shall be of heavy gauge aluminum construction and shall be weatherproof, incorporating an integral weather shield. Ventilators shall be mounted in wall as shown on the drawings.
1. Fan wheels shall be propeller design that have been statically and dynamically balanced. Tip speed, rpm, and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.
 2. Fans shall have integral factory-formed base fabricated to the dimensions shown on the drawings. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have sizes as scheduled. Provide a speed controller located in the motor housing as scheduled on drawings. Some level shall be limited to 18.0.
 3. Fans shall be provided with integral unit mounted disconnect switches.
- B. Belts: The fans, where specified, shall be connected to the driving motor by means of a V- belt drive, with a minimum of 2 strands, unless otherwise designated. 2-strand V-belt drives shall be designed for 100% overload capacity, multiple strand V-belt drives shall be designed for 50% overload capacity, and the motors for such drives shall be equipped with adjustable bases or slide rails. Multiple belts shall be matched. When replacement of one or more belts of a set is necessary, entire set shall be replaced with new matched belts. Multiple belts shall be so designed as to minimize whip, turn over and throw off.
- C. Sheaves: It shall be the responsibility of the Contractor to see that all design static pressures are met. Provide adjustable sheaves for design static pressure. Provide adjustable sheaves for one or two-strand belt drives. Sheaves shall be selected to operate at the mid-point of the fan curve so as to allow adjustment in both directions. For multiple- strand drives, provide fixed sheaves. Replace fan sheaves as necessary to obtain desired results. All fan sheaves and motor sheaves shall be dynamically and statically balanced before assembly.
- D. Wheels and Bearings: Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically, and be free from objectionable vibration or noises. Bearings shall be medium-duty, self-aligning, ball or roller bearing, sealed, pillow block type, and shall be complete with lubrication fittings, extended for easy access where necessary.
- E. Acceptable Manufacturers :
1. Loren Cook.
 2. Greenheck.
 3. Penn.
 4. Or approved equal.
- F. Shafts: Fabricate of steel, with first critical speed of wheel and shaft of not less than 1.25 times the maximum speed specified. All shafting be turned, ground and polished to close tolerances.
- G. Fan Curves: Furnish performance curve data sheet with shop drawings of fans submitted for review. All fan performance ratings and data shall be AMCA certified ratings in accordance with Standard AMCA test code method and procedure.

2.07 FAN COIL

- A. General: Indoor, direct-expansion, wall or ceiling-mounted as shown on the drawings, fan coil. Unit shall be complete with coil, fan, motor, piping connectors, electrical controls, microprocessor control system, integral temperature sensing, and a holding charge of R-22 refrigerant. Unit shall be furnished with integral mounting bracket.
- B. Unit Cabinet: Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene or galvanized steel.
- C. Fan: Fan shall be blower type with air intake and discharge at the bottom front. Automatic motor-driven horizontal air sweep shall be provided standard.
- D. Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate.
- E. Motors: Motors shall be permanently lubricated with inherent overload protection. Fan motors shall be multi-speed and totally enclosed.
- F. Controls: Controls integral with the unit shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The unit shall have:
 - 1. An automatic restart after power failure at the same operating conditions as at failure.
 - 2. A timer function to provide a minimum 15-hour timer cycle for system on or off.
 - 3. Temperature-sensing controls and a high discharge temperature shut down.
 - 4. Wired control to enter set points and operating controls (required accessory).
 - 5. Filter status indication after 250 hours of indoor fan operation.
 - 6. Test mode button to run self-diagnostics and aid in troubleshooting.
- G. Filters: Unit shall have filter track with factory-supplied cleanable filter.
- H. Wired Remote Controller: Provides 2-way communication capability of system inputs and outputs. The liquid crystal display (LCD) provides continuous status of the system operating conditions. The kit comes with 15 ft. of interconnecting cable which may be extended up to 100 ft. and shall be located inside of the conditioned space.
- I. Acceptable Manufacturers:
 - 1. Carrier
 - 2. Trane
 - 3. Daiken
 - 4. Or approved equal

2.08 AIR COOLED CONDENSING UNITS (OUTDOOR):

- A. General: Factory assembled, single piece, air-cooled condensing unit (outdoor). Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, charge of R-22 refrigerant, capillary tube metering device, and special features required prior to field start-up.

- B. Unit Cabinet:
1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a CTA blue baked enamel finish.
 2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
- C. Fans:
1. Condenser fans shall be direct-drive propeller type, discharging air horizontally, drawing air through the condenser coil.
 2. Condenser fan motors shall be totally enclosed, single phase motors with permanently lubricated ball bearings. Motor shall be protected by internal thermal overload protection.
 3. Shaft shall have inherent corrosion resistance.
 4. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
 5. Condenser fan openings shall be equipped with grille cover and screen protection grille.
- D. Compressor:
1. Compressor shall be hermetic rotary type.
 2. Compressor shall be equipped with oil system, operating oil change, suction line accumulator, muffler, eccentric shaft, and motor.
 3. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
 4. Casing shall include discharge valves, discharge muffler, pump bearing, piston, and vanes.
 5. Compressor assembly shall be installed on rubber vibration isolators.
- E. Condenser Coil: Coil shall be constructed of aluminum fins mechanically bonded to smooth, seamless copper tubes which are cleaned, dehydrated, and sealed.
- F. Refrigeration Components: Refrigerant circuit components shall include liquid line service valve, suction line service valve with service gage connection port, discharge line service port, accumulator, cooling capillary tubes, pressure relief, and an operating charge of refrigerant.
- G. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled and tested. The minimum control function shall include:
1. Controls:
 - a. Time delay restart to prevent compressor short cycling.
 - b. Automatic restart on power failure.
 2. Safeties:
 - a. High temperature protection.
 - b. Freeze-up protection.
 - c. System diagnostics.
 - d. Compressor motor current and temperature overload protection.
 - e. High pressure relief.
 - f. Condenser fan failure protection.
- H. Acceptable Manufacturers:

1. Carrier
2. Friedrich
3. Daiken
4. O Approved Equal

2.09 FAN-FORCED WALL HEATERS

- A. Enclosures shall be constructed from minimum 16 guage steel, commercial quality, suitable to withstand heavy duty use.
- B. Enclosures shall be chemically treated to resist corrosion then finished in baked enamel and satin finished aluminum frame. Color shall be submitted for approval.
- C. Back panel shall be painted, completely finished and suitable for installation on concrete block construction with applied finish scheduled on the Drawings.
- D. Motor and blower fans are direct drive connection and mounted as a single assembly on rigid heavy gauge frame for long, vibration free life.
- E. Steel finned metal sheath heating element shall be center anchored, and ensure noiseless expansion and contraction.
- F. Units shall have overheat protection over the entire length of the element through a capillary type cut out. Overheat protection shall restore operation automatically when cause of overheat is removed from the element.
 1. As scheduled or specified in the contract documents, furnish units with integral, adjustable thermostats. Unless called for differently on the drawings.
- G. Acceptable Manufacturers:
 1. Q-Mark
 2. Markel
 3. Becko
 4. Or approved equal

2.10 REPLACEABLE (THROWAWAY) PANEL FILTERS

- A. Description: Factory-fabricated, viscous-coated, flat-panel type, replaceable air filters with holding frames in sizes and having performance characteristics as required.
- B. Media: Throwaway media of interlaced glass fibers, sprayed with nonflammable adhesive.
- C. Frame: Cardboard frame with perforated metal retainer.
- D. Duct Holding Frames: 16-gage (0.9mm) galvanized steel capable of holding media and media frame in place, with gaskets to prevent unfiltered air bypass.

E. Acceptable Manufacturer:

1. American Air Filter Co.
2. Farr Co.
3. Continental Air Filters.
4. Cambridge Filter Corp.

2.11 REFRIGERATION PIPING MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as required. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems.

2.12 BASIC PIPES AND PIPE FITTINGS

- A. General: Provide pipe, tube, and fittings complying with Basic Mechanical Materials And Methods, in accordance with the following listing:
1. Tube Size 3/4" and Smaller: Copper Tube: Type ACR, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints.
 2. Soldered Joints: Solder joints using silver-lead solder, ASTM B 32, Grade 96 TS.

2.13 CONTROL DEVICES

- A. Control devices are specified in Specification Section Controls.

2.14 AUTOMATIC DAMPERS

- A. General: Automatic motorized dampers shall have frames of minimum 13 gauge (2.3mm) galvanized steel not less than 2" (50 mm) in width and aerodynamically formed blades of 16 gauge (1.5 mm) galvanized steel. Dampers shall be adequately braced to form a rigid assembly. No dampers shall have blades more than 4" (10 cm) wide. Length of blades shall be not more than 48" (122 cm). Blades shall be secured to 1/2" (13 mm) diameter zinc plated axles by zinc plated bolts and nuts. All blade bearings shall be nylon or bronze. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blade linkage hardware shall be constructed of corrosion resistant, zinc plated steel and brass.
- B. Size and Selection: Dampers shall be suitable for operation within a temperature limit range of -40 to 200 degrees F. (-39.8 to 93 degrees C.) The control manufacturer shall submit leakage and flow characteristics plus a size schedule for all controlled dampers.
1. Dampers shall be of the parallel design with replaceable butyl, spring stainless steel or closed cell neoprene edging.
 2. Dampers located adjacent to intake louvers shall be furnished in sizes as indicated.
- C. Acceptable Manufacturers:
1. Ruskin
 2. Vent Products
 3. Or approved equal

2.15 ELECTRIC OPERATORS

- A. General: Actuators for dampers shall be two-position line voltage (120 Volt AC) with manually adjustable minimum position and with lock, reversing type as required by the application. Where specified or required by the application, actuators shall have a spring mechanism to return the damper to a predetermined position in the event of a power interruption. Actuators shall have position indicators to show the position of the actuator over the full stroke.
- B. Damper Operation Locations: Damper motors shall be installed and attached to the frame of the damper, and connected to an extended shaft, as required, in order to meet the specific conditions of the job.
- C. Acceptable Manufacturers:
 - 1. Honeywell
 - 2. Ruskin
 - 3. Barber-Coleman
 - 4. Siebe
 - 5. Siemens
 - 6. Or approved equal

2.16 MISCELLANEOUS EQUIPMENT

- A. Provide necessary two-position, capacity and electric sequencing relays and miscellaneous items required for the successful operation and sequencing of the systems herein specified. Relays and switches shall be UL listed, and of voltage and current characteristics to meet application.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which units shall be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 EQUIPMENT INSTALLATION

- A. The following mechanical equipment shall be installed, wired with controls and placed in operating condition.
 - 1. Fans as listed in Exhaust Fan Schedule.
 - 2. Automatic Dampers.
 - 3. Ductless Split Fan Coil and Outdoor Condenser. (and VRF Systems)
 - 4. Power Roof Ventilators.
 - 5. Forced-Fan Wall Heaters.
 - 6. Air Filters
 - 7. Infrared Heaters
 - 8. Ductwork
 - 9. Grilles, Registers, Diffusers, Gravity and Counter Balanced Dampers and Louvers.
- B. Electric wall mounted disconnect switch shall be furnished, installed and wired under Electrical Sections

- C. All necessary starters for exhaust fan motors as shown on electric schematic diagrams shall be furnished, installed and wired under Electrical Sections.

3.03 INSTALLATION OF REFRIGERANT PIPING

- A. General: Install refrigerant piping in compliance with equipment manufacturer's recommendations.
- B. Install refrigerant piping with 1/4" per foot (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.
- C. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.
- D. Bleed dry nitrogen through refrigerant piping during brazing operations.

3.04 INSTALLATION OF REFRIGERATION PIPING SPECIALTIES

- A. Install piping specialties in accordance with requirements of Section Basic Mechanical Materials And Methods.

3.05 INSTALLATION OF REFRIGERATION PIPING SUPPORTS AND ANCHORS

- A. Install supports and anchors in accordance with requirements of Section Basic Mechanical Materials And Methods.

3.06 INSTALLATION OF SPECIAL REFRIGERANT VALVES

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing, replace after joints are completed.
- B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.07 DEHYDRATION AND CHARGING REFRIGERATION SYSTEM

- A. Evacuate refrigerant system with vacuum pump, until temperature of 35 degrees F is indicated on vacuum dehydration indicator.
- B. During evacuation, apply heat to pockets, elbows, and low spots in piping.
- C. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
- D. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
- E. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.08 INSTALLATION OF FAN FORCED WALL HEATER.

- A. Install heaters as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that heating terminal

equipment fulfills requirements. Comply with applicable installation requirements of NEC and NECA's "Standard of Installation".

- B. Coordinate with electrical work, including wiring/cabbling work, as necessary to interface installation of heating terminals with other work.
- C. Clean dust and debris from heater as it is installed to ensure cleanliness.
- D. Comb out damaged fins where bent or crushed before covering elements with enclosures.
- E. Touch-up scratched or marred heater enclosure surfaces to match original finishes.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.
- G. Grounding:
 - 1. Provide equipment grounding connections as indicated. Tighten connections to comply with tightening torque values specified in UL Std. 486A to assure permanent and effective grounds.

3.09 INSTALLATION OF AIR FILTERS

- A. Install filter frames level and plumb, following manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- B. Install air filters and holding devices of types indicated and where shown following air filter manufacturer's written instructions and with recognized industry practices to ensure that filters comply with requirements and serve intended purposes.
- C. Locate each filter unit accurately in position indicated in relation to other work. Position unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- D. Install filters in position to prevent passage of unfiltered air.

3.10 CONNECTIONS

- A. Coordinate filter installations with fans, dampers, duct and air conditioning unit installations.

3.11 CLEANING

- A. After testing, adjusting, and balancing air conditioning and air-distribution systems, clean outside air intake and clean filter housings and install new filter media.

3.12 ELECTRICAL WIRING

- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted.
- B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to the Authority.

3.13 ADJUSTMENT AND CLEANING

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
- B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- C. Install new filter units for terminals requiring same.

3.14 TESTING

- A. Upon completion of installation of heating terminals and after building circuitry has been energized, test heating terminals to demonstrate operability and compliance with requirements. Where possible, field correct malfunctioning units, then retest to demonstrate compliance.

END OF SECTION 23 00 00

SECTION 23 07 00
MECHANICAL INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall furnish all labor, material, equipment, and services necessary to furnish and install thermal duct insulation and equipment insulation at the location as directed and required by the Authority.

1.02 RELATED DOCUMENTS:

- A. General provisions of Contract apply to this Section.

1.03 RELATED WORK:

- A. Section 22 07 00, Pipe Insulation.

1.04 SUBMITTALS

- A. The Contractor shall furnish product data, technical data, samples, installation instructions and shop drawings as required below:
 - 1. Product Data: Provide product description, list of materials, and thicknesses for each type and application of insulation, cement, adhesive, sealant, tape, attachment device, jacket, cover and other accessory.
 - a. Provide specifications and test data indicating thermal performance standards of insulating products.
 - b. Provide data for each insulating product indicating thickness of material and related R value.
 - 2. Provide product data, specifications, technical data and shop drawings for any equipment insulation indicating thickness, R values, size and profile of equipment to be insulated, location of protrusions, access requirements, method of attachment and seam closure method.
 - 3. Samples: Submit two (2) samples of any representative size illustrating each insulation and accessory type. Provide samples of any jackets or covers in actual color and finish to be supplied.
 - 4. Manufacturer's installation instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.
 - 5. Manufacturer's certificate of compliance and thermal efficiency.
 - 6. Copy of manufacturer's warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer of insulation shall have been producing the products successfully for a period of at least five years and be able to provide documentation that the products meet all specified requirements.
- B. The material(s) required for the work will be furnished by the Contractor. All material(s) furnished by the Contractor shall be new and shall meet the standards and requirements specified by the applicable institutions and organizations (i.e. ASME, ASTM, NFPA, and EPA), and local building codes.

- C. All installation of insulation shall follow the insulation manufacturer's recommended procedures and meet the standards and requirements specified by the applicable institutions, organizations, Federal, State, and Local building codes.

1.06 REFERENCE STANDARDS

- A. American Society for Testing and Materials:
 - 1. ASTM E 84, Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
 - 1. NFPA 255, Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters' Laboratories:
 - 1. UL 723 Fire and Smoke Hazard Classification.

1.07 SEQUENCING/SCHEDULING

- A. The Contractor shall schedule and perform tasks required for furnishing and installing the thermal insulation and accessories in conformance with the requirements of the accepted project schedule.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation products to the site in unbroken shipping cartons bearing a label indicating the contents and the appropriate ASTM, NFPA and UL flame and smoke hazard ratings as specified herein for the various insulation products.
- B. Deliver and store insulation products protected from the weather. Store insulation on the site elevated off wet and otherwise contaminating surfaces.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 THERMAL INSULATING MATERIALS, GENERAL:

- A. Rigid Thermal Insulation: Use rigid insulation manufactured of molded glass fiber with composite (insulation, jacket or facing, and sealing adhesive) fire and smoke hazard ratings meeting requirements of NFPA 90A Standards, tested per ASTM E 84, NFPA 255 and UL 723, not to exceed a "Flame Spread" rating of 25 and a "Smoke Developed" rating of 50 except as noted herein. Products or their shipping cartons shall bear a label indicating above requirements. Insulation shall have a maximum thermal conductivity of 0.23 BTUH per sq. ft. per degree F. per inch at 70 degrees F. mean temperature. The water vapor transmission rating shall be less than 0.2 perms per inch using a jacket of white kraft bonded to aluminum foil and reinforced with fiberglass yarn.

- B. All exterior equipment shall be insulated with cellular glass type insulation having integral self sealing jacket.
- C. Fitting Insulation (Rigid): Insulate fittings and valve bodies with factory pre-molded one-piece insulation. Insulation inserts of noncombustible glass fiber shall have a K factor of .27 at 75 degrees F. mean temperature.

2.02 EQUIPMENT INSULATION

- A. Preformed rigid or soft insulation composed of calcium silicate, cellular glass, flexible elastomeric, mineral or glass-fiber blanket, mineral or glass-fiber board, phenolic, polyisocyanurate, polyolefin or polystyrene as submitted and approved by the Authority.
- B. Acceptable Manufacturers of equipment insulation (depending on material):
 - 1. The Industrial Insulation Group.
 - 2. Cell-U-Foam Corporation.
 - 3. Pittsburg Corning Corporation.
 - 4. Aeroflex USA, Inc.
 - 5. Armacell LLC.
 - 6. RBX Corporation.
 - 7. CertainTeed Corporation.
 - 8. Johns Manville.
 - 9. Knauf Insulation.
 - 10. Manson Insulation.
 - 11. Owens Corning.
 - 12. Fibrex Insulations, Inc.
 - 13. Rock Wool Manufacturing Company.
 - 14. Roxul Inc.
 - 15. Thermafiber.
 - 16. Kingspan Corporation.
 - 17. Apache Products Company.
 - 18. Dow Chemical Company.
 - 19. Duna USA Inc.
 - 20. Elliott Company.
 - 21. Nomaco Inc.
 - 22. Approved Equal.

2.03 INSULATING CEMENTS

- A. Mineral Fiber certified to meet the requirements specified in the current edition of ASTM C 195.
 - 1. Thermal Conductivity: Average max. 1.0 BTU in./h ft² °F at 500 °F mean temperature.
 - 2. Minimum compressive strength: 10 p.s.i. at 5 percent deformation.
- B. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement certified to meet the requirements specified in the current edition of ASTM C 449.
 - 1. Apparent Thermal Conductivity: Average max. 1.2 BTU in./h ft² °F at 400 °F mean temperature.
 - 2. Minimum compressive strength: 100 p.s.i. at 5 percent deformation.

2.04 PREFORMED GLASS FIBER

- A. Molded and jacketed inorganic glass fibers, bonded with a thermosetting resin, into products preformed via a molding process to yield rigid full-round cylindrical pipe insulation sections, certified to meet the requirements specified in the current edition of ASTM C 547, for Type I insulation.
1. Apparent Thermal Conductivity: Average max. 0.26 BTU in./h ft² °F at 75 °F mean temperature.
 2. Density: Average max. 10 lb/ft³
- B. Surface Burning Characteristics: All preformed glass fiber insulation shall have composite (insulation, jacket, tape seal, and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard ratings as tested in accordance with the current editions of ASTM E 84, NFPA 255 and UL 723, not exceeding
1. Flame Spread 25
 2. Smoke Developed 50
- C. Hot-Surface Performance: All preformed glass fiber insulation shall not flame, glow, smolder, crack, delaminate or warp after 96 hours exposure to the heated surface of a heating pipe when tested in accordance with the current edition of ASTM C 411.
- D. Jacketing: The preformed glass fiber insulation shall be furnished with either a foil and paper jacket with end joint butt strips or an aluminum jacket. All jacketing shall conform to the requirements specified herein under Article 2.05-Jackets.

2.05 JACKETS

- A. Foil and Paper Jacket- Laminated glass-fiber-reinforced, flame-retardant Kraft paper and aluminum foil having self-sealing lap conforming to the current edition of ASTM C 1136, Type I, and ASTM C 921, Type I or Type II.
1. Water Vapor Permeance: 0.02 perms maximum, when tested in accordance with the current edition of ASTM E 96.
 2. Puncture Resistance: 50 beach units minimum, when tested in accordance with ASTM D 781-84.
- B. Aluminum Jacket - Aluminum jacketing material shall be Alloy 3003, H14 temper roll stock, ready for shop or field fabrication to required sizes, in compliance with the current edition of ASTM B 209.
1. Finish and Thickness: Smooth finish, 0.010 inch to 0.016 inch thick.
 2. Moisture Barrier: Factory applied 1-mil, heat bonded polyethylene and Kraft paper.
 3. Moisture Barrier: Factory applied 3-mil Dupont Surlyn, or approved equal.
- C. Aluminum fitting jackets shall be factory preformed from the same material having the same finish, moisture barrier, and thickness as that specified for jackets.
- D. All straight runs of pipe insulation are to be protected with Childers Corrolon or approved equal aluminum jacketing. The jacketing is to be manufactured from .016" type 3003 or 5005 aluminum. All jacketing shall have an integrally bonded polykraft moisture barrier over the entire surface in contact with the insulation. All jacketing shall be installed in accordance with manufacturer's latest published recommendations.
- E. All 90 degree F and 45 degree F insulated elbows having a nominal iron pipe size of ½" to 12", inclusive, shall be protected with Childers Aluminum Ell-Jacs or approved equal

manufactured from 1100 Aluminum alloy in .024" thickness. The Ell-Jacs shall be installed in accordance with manufacturer's latest published recommendations.

2.06 STANDARD PVC FITTING COVERS

- A. Factory-fabricated fitting cover consisting of one-piece, pre-molded, PVC covers manufactured from 20-mil thick, high-impact, ultraviolet-resistant PVC.
 - 1. Shapes: 45- and 90-degree, short- and long-radius elbows, reducers, end caps, soil-pipe hubs, traps, mechanical joints, roof drains, and P-trap, in compliance with the current edition of ASTM C 585.
 - 2. Smooth high gloss surface that does not promote bacteria or fungi growth.

2.07 ATTACHMENTS, ADHESIVES AND SEALANT MATERIAL

- A. Metal bands shall be 3/4 inch wide x 0.020 inch thick Type 304 stainless steel.
- B. Wire tie material shall be one of the following: 14 gage nickel-copper alloy, 16 gage soft-annealed stainless steel, or 16 gage soft-annealed galvanized steel as indicated in the contract document.
- C. Adhesives for the flexible elastomeric cellular insulation shall be solvent based, and suitable for the insulation furnished as recommended by the insulation manufacturer.
- D. Adhesives for rigid preformed glass fiber insulation shall be non-flammable, solvent based and have a service temperature range of minus 20 °F to plus 180 °F.
- E. Vapor Barrier Compound shall be a water-based fire-resistive composition exhibiting the following characteristics.
 - 1. Water Vapor Permeance: 0.08 perm maximum.
 - 2. Temperature Range: Minus 20 °F to plus 180 °F.
- F. Weatherproof Sealant: Flexible-elastomer-based, vapor barrier sealant designed to seal metal joints.
 - 1. Water Vapor Permeance: 0.02 perm maximum.
 - 2. Temperature Range: Minus 50 °F to plus 250 °F.
 - 3. Color: Aluminum.

PART 3 EXECUTION

3.01 INSPECTION

- A. Carefully inspect installed work of other Trades in connection with insulating work and verify such work shall be complete, including system or equipment testing, to such point where insulating work may begin.
- B. Verify that ductwork and/or equipment has been tested and approved before applying insulation materials.

3.02 PREPARATION

- A. Apply insulation on clean, dry surfaces only and without foreign materials. Perform cleaning required for removal of construction debris, spills, etc. prior to installation.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Install insulation continuous through structure penetration of surfaces being insulated. All duct insulation shall be continuous through walls, ceilings, floor openings or sleeves except where firestop or firesafing materials are required.
- C. Insulation installed on ductwork or equipment operating below ambient temperatures shall have a continuous vapor barrier. Adequately seal hanger, support, and anchor penetrations of insulation. All joints, seams and fittings shall be sealed with approved materials.
- D. Apply specified insulation adhesive, sealers and coatings at the manufacturer's specified minimum coverage per gallon.

3.04 PIPING INSULATION:

- A. Apply insulation materials on work and equipment in accordance with thicknesses recommended by manufacturer for local climatic conditions. Insulate fittings and valve bodies and in-line control devices, except gage and thermometer faces, setting or measuring scales integral with in-line devices and control handles.
- B. Rigid Insulation Installation: Install on work or equipment according to manufacturer's instructions, using specified adhesive to seal both longitudinal jacket laps and butt strips. Insulate in-line appurtenances with factory-premolded one-piece insulated covers as previously specified. Secure fitting cover by stapling first followed by a tape sealing using tape specified by the fitting cover manufacturer.
- C. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining equipment, and finish with glass mesh reinforced vapor barrier cement applied in two inch thick coats. Install the glass reinforcing mesh in the first coat while tacky and allow to dry before applying the second coat. Cover with aluminum jacket with seams located on bottom side of horizontal piping and facing building wall on vertical pipe. Secure cover with ½ inch wide aluminum draw bands on maximum 2 foot (610 mm) centers, or edges with aluminum sheet metal screws on maximum 4 inch (102 mm) centers. Caulk seams with flexible latex caulking.
- D. Insulate ductwork and equipment less than 8 feet above finished floors in locations accessible to personnel contact so that temperatures of exposed surfaces do not exceed 180 degrees F (82 degrees C).
- E. Carry vapor barriers down and seal to the cold surface at not more than 50 foot (15 meters) intervals on horizontal runs and at not more than 10 foot (3 meters) intervals on vertical runs.
- F. Vapor barrier jackets may be all purpose jackets, foil-scrim-kraft jacket, minimum 3 mil plastic sheeting, or spray on plastic coatings.
- G. Provide a factory or field applied fiberglass cloth jacket over all vapor barriers, except all purpose jackets, on all piping exposed to view or specified to be painted.
- H. Provide a factory or field applied fiberglass cloth jacket over all thermal insulation exposed to view or specified to be painted, except all purpose jackets. Size all insulation exposed to view in accordance with section painting.

- I. Adhesives and fasteners used to secure jackets and covers on insulation shall be vermin, rodent and mildew resistant and have a smoke and flame spread rating equal to or.
- J. Apply insulation so that it does not interfere with the operation of control valves or servicing of equipment, valves or controls. Apply insulation so that access doors, covers, panels and access plates on equipment and piping can be removed, opened or operated without damage to the insulation. Insulation shall not cover nameplates, inspection stamps, rating plates, code stamps, and similar information attachments.
- K. All ends of insulation materials shall be firmly butted and secured with appropriate butt strip materials.
- L. When installing insulation cover seams, locate in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

3.05 CLEANUP

- A. The Contractor shall ensure a general clean up is conducted at all work sites at the close of each workday. All waste material or rubbish (e.g. old insulation) must be disposed of in accordance with all applicable City and State regulations in effect for the work area, including disposal of waste in a licensed yard and/or refuse land fill.
- B. Contractor shall not dispose of waste material or rubbish into the Authority's refuse containers or anywhere else on or about the Authority's property.
- C. Contractor shall keep premises free from accumulation of waste material or rubbish as the work progresses. At completion of work, the Contractor shall remove all rubbish from the worksite and shall remove all tools, scaffolding and surplus materials, leaving the work area "broom clean". In case of dispute, the Authority may remove rubbish and charge such costs to the Contractor. Any damages caused by the Contractor, either directly or indirectly, shall be the sole responsibility of the Contractor.

3.06 DEFECTIVE MATERIALS OR WORKMANSHIP

- A. All material and workmanship covered by this specification shall be subject to the inspection and approval of the Authority and shall be in conformance with this specification, all relevant codes and requirements and good practice. All materials used for this work shall be new, in original packaging and undamaged prior to installation.
- B. Any defective material shall be immediately removed from the premises by the Contractor and replaced at no cost to the Authority. Any defective workmanship shall be promptly corrected to the satisfaction of the Authority and at no cost to the Authority.

END OF SECTION 23 07 00

SECTION 23 83 13
ELECTRIC HEAT TRACING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies the furnishing and installing of electric heat trace systems for protecting water pipes and drains from freezing.
- B. The Contractor shall furnish and install complete and functional heat trace systems including wiring; controls; thermostats; all electrical connections and any conduit, cable, boxes, outlets and other equipment and accessories required.
- C. Related work specified elsewhere:
 - 1. Section 22 07 00, Mechanical Insulation.

1.02 SUBMITTALS

- A. The Contractor shall prepare and submit, before fabrication and assembly of the heat trace system equipment, the following:
 - 1. Shop drawings showing the layout of each pipe line to be protected, equipment drawings showing the details of the wiring, thermostat, controls, connections, warning lights and alarms and control panels.
 - 2. Calculation data showing the electrical load data for each system.
 - 3. Product data, catalog cuts and specifications describing the electrical and physical characteristics of each item including the thermostat, controls warning lights and alarms and control panels.
 - 4. Installation instructions for the system.
- B. The Contractor shall submit, for record and distribution, prior to shipment of the equipment, five copies of Operation and Maintenance manuals for the heat trace system.
 - 1. Operation and Maintenance manuals shall include descriptive bulletins and operation leaflets for the thermostats, controls and warning lights and alarms.
 - a. Each Operation and Maintenance manual shall contain the "Record Document" Drawings, complete operating and instruction manuals, spare parts lists, certified test documents, and other special data required for this equipment.
 - 2. Spare parts bulletins shall be included with catalog cuts for each item.
 - 3. Certified test reports shall include all assembly and subassembly test and inspection reports.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall furnish all necessary labor and tools, materials, and equipment and shall properly construct and connect the electric heat trace system in accordance with the manufacturer's directions and recommendations.
- B. The electric heat trace cable shall be either be covered with a protective nickel braid or covered with a tinned copper braid and a corrosion protective outer fluoropolymer jacket.
- C. The Contractor shall coordinate the design and installation of the heat trace system with the pipe insulation system.
- D. The design, selection and size of the heat trace cable shall be in accordance with correct heat transfer calculations as recommended by the equipment manufactures design guide.
- E. The system shall be controlled and monitored from a single control panel. The system shall be controlled from a thermostat with provisions for a manual override from a Hand-Off-Auto switch.
- F. Monitoring and alarm circuits shall be provided that monitor each heat trace circuit for current and continuity of the heat trace cable, and the entire system for low temperature failure.
- G. The electric heat trace cable, control panel, and accessories shall have UL, FM, or CSA system listing.

2.02 MATERIALS

- A. The Contractor shall furnish and install the electric heat trace system which shall include but not be limited to the electric heat trace cable, tape or banding, thermostats, control panel and warning lights and alarm.
- B. The electric heat trace system for freeze protection shall be controlled from a common ambient sensing thermostat set to activate the system at 40 degrees, and a parallel backup thermostat set at 40 degrees F. An alarm shall be provided to indicate the failure of either thermostat or lack of power.
- C. The control panel shall provide for the necessary controls and contactors plus an additional 25 percent spare space. The contactors shall be electrically operated, electrically held, 30 ampere, 600 Volt, 3 pole, with a 120 Volt control coil. The contactors shall be as manufactured by Allen Bradley or Square D.
- D. LED pilot lights shall be provided to indicate control power available, system on, off, and circuit on and failure alarms for each heat trace circuit.
- E. The system and all components shall be approved by the Authority.
- F. The cable shall be industrial type, rated 8 watts per foot (W/ft), at 120 volts, at a temperature of 50 degrees F. and a temperature identification number (T-rating) of T6 (185 degrees F. exposure). Values shall be established per Institute of Electrical and Electronics Engineers, Incorporated (IEEE) Standard 515, Testing, Design, Installation and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications.

- G. The heating cable shall be self-regulating. The cable heat output shall decrease with raising ambient temperature without employment of an auxiliary electrical regulatory device.
- H. The heating cable shall be composed of two parallel 16 AWG (or larger) stranded, nickel-plated copper bus wires, embedded in a polymeric conductive (heat generative) core (web). The wires and core shall be enclosed within a tinned copper, braided shield, suitable for use as an electrical fault grounding conductor. All cable components shall be jacketed with a tough, abrasion and moisture resistant thermoplastic (e.g. polyolefin), inert with aqueous and cleaning chemicals. The overjacket shall provide corrosion protection for the cable. A polyolefin or fluoropolymer overjacket is an acceptable alternate.
- I. The cable shall have, monitor wires and a tinned copper braid, with a fluoropolymer jacket for mechanical and corrosion protection. The cable is suitable for direct placement on metallic and polyvinyl chloride (PVC) piping. The heat trace circuits shall be designed to operate on 20 ampere circuits.
- J. The heating cable shall be unaffected by exposure to non-hazardous, unshielded indoor and outdoor environmental conditions. The cable service life shall not be diminished by exposure to ultraviolet radiation and random fluctuating temperatures within the range of -30 degrees to 150 degrees F.
- K. The cable shall have a minimum expected service life of 10 years in applications of continuous operation. A minimum of 90% of the nominal rated power shall be exhibited following 1000 hours of continuous operation, in accordance with Underwriters Laboratories, Incorporated (UL) Standard 746B, Polymeric Materials – Long Term Property Evaluations.
- L. Heating cable shall be UL approved. Cable shall have original manufacturer's labeling.
- M. The heat trace system shall be as manufactured by Delta-Therm, Chemelex, Bylin or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Heat tracing shall be installed on clean surfaces free of dirt, debris, protrusions, oil, grease and moisture. Remove existing insulation, if any, as required for proper installation of the heat trace cable. Remove existing heat trace system or components as required for installation of the new system or components.
- B. Locations for installation of the control panel, thermostat and warning light and alarm shall be approved by the Authority.

3.02 INSTALLATION

- A. The heat trace cable shall be installed in such a manner as to maintain the best possible contact with the traced pipe, valves, flanges and other in-line equipment. The heat tracing cable shall be secured to the pipe as recommended by the heat trace system manufactures installation instructions.
- B. In order to allow for maintenance access to valves, strainers, and other in-line equipment where additional heat tracing is required, a loose loop of heating cable of the length required shall be left at the item to be traced. The loop shall be spiraled around the item

and secured as recommended by the heat tracing system manufacture's installation instructions.

- C. All junction boxes, splices, and terminations requiring maintenance shall be mounted to be accessible without disturbing the insulation and jacket.
- D. The location of the ambient sensing thermostats shall be selected to obtain a representative temperature, be accessible for maintenance, and protected from tampering.
- E. The installation and final adjustments to the electrical heat tracing system shall be supervised and field tested by a qualified factory trained equipment manufactures service engineer.
- F. After field testing has been completed the installed heat trace system shall be covered with insulation and a jacket as specified in pipe insulation section of this Specification.
- G. All pipe electrically heat traced and insulated shall have a plastic label applied to the insulation every 25 feet. The plastic label shall read "Electric Heat Trace Circuit Number, Panel Number.
- H. Unless otherwise approved, cable of 1000 feet in length and shorter shall be furnished in one piece. Cable of greater lengths shall be furnished in increments of this length or longer.

3.03 ELECTRICAL CONNECTIONS

- A. Final electrical connections between the heat trace system and the power source and the energizing of the system will be performed by the Authority's electrical department unless directed and approved otherwise.

3.04 RE-INSULATION

- A. Re-insulate or insulate over the new heat trace cable after installation. See insulation specification. Type of insulation must be approved to be used with the heat trace cable to avoid fire and other hazards. Insulate according to manufacturer's directions. Take precautions to not damage the heat trace cable.

3.05 OPERATION AND MAINTENANCE MANUAL

- A. Upon completion, Contractor shall test system for proper operation and set controls.
- B. The equipment manufacturer and installer shall provide adequate training for the Authority's Personnel in the proper operation and maintenance of the equipment.

- C. The installer shall provide as built drawings indicating the location of heat tracing and location of connections, controls, thermostats and warning lights and alarms. The manufacturer shall provide final and complete operation and maintenance manuals for all components of the heat trace system.

END OF SECTION 23 83 13

SECTION 23 83 33
RADIANT HEATING UNITS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Electric radiant heaters.

1.02 SUBMITTALS

A. Product Data: Include rated capacities, specification sheets, UL approval certificate, specialties, and accessories for each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Include rough opening dimensions and other opening requirements for recessed and semi-recessed units. Detail equipment assemblies and attachment. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For electric radiant heaters to include in operation, and maintenance manuals.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. All electric heaters to be U.L. approved.

1.04 COORDINATION

A. Coordinate layout and installation of radiant heaters and components with other construction.

PART 2 PRODUCTS

2.01 ELECTRIC RADIANT HEATERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Berko Electric Heating; a division of Marley Engineered Products.
2. Chromalox Inc.; a division of Emerson Electric Company.
3. Fostoria Industries, Inc.; a division of TPI Corporation.
4. Markel Products; a division of TPI Corporation.
5. Omega Engineering, Inc.
6. QMark Electric Heating; a division of Marley Engineered Products.
7. Aitken Products

8. Approved equal
- B. Units to be UL approved.
- C. Enclosures: Painted steel housing with anodized-aluminum reflector.
 1. Finish: Baked-enamel finish in manufacturer's standard paint color as selected by Architect.
- D. Unit Controls:
 1. Line-voltage thermostat.
- E. Capacities and Characteristics:
 1. Enclosure Length.
 2. Mounting Height.
 3. Heating Capacity.

2.02 FAN-FORCED ELECTRIC WALL HEATER

- A. Electric semi-recessed wall mounted thermostat controlled with fan and built-in fan delay switch to energize fan motor after elements are heated and shuts off fan motor when residual heat has been dissipated after heat shuts off.
 1. Fan motor to have lifetime lubricated bearings. Fan sized per drawing documents.
 2. Heater to have a power disconnect switch and be equipped with a thermal overheat protection in the event of overheating.
 3. Heater to have an integral built-in thermostat; adjustable at front cover, unless different controls called for on construction documents
- B. Enclosure: Semi-recessed housing to be 20 gauge minimum galvanized metal. Front cover and grill to have a neutral gray baked enamel finish.
- C. Heating elements to be steel finned metal sheath.
- D. The wall mounted electric heater for this project shall be Q Mark CWH 3000 series, or another manufacturer's model submitted to the Authority for approval as an equal.
 1. Provide a heater to provide wattage and phase requirements as shown on construction drawings, of 240 volts, single phase.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive radiant heating and cooling units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for electrical connections to verify actual locations before radiant heating unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install radiant heating and cooling units level and plumb.
- B. Verify that size of opening for semi-recessed wall heater is of proper size and depth for proper installation of the heater. Follow manufacturer's directions and installation drawings.
- C. Install wall heaters and baseboard heaters at locations indicated on the drawings. Verify sizes and conditions in the field. Install wall heater at height from floor recommended by manufacturer.
- D. Secure heaters to wall as recommended by manufacturer, using approved fasteners required to secure heaters to the specific substrate.

3.03 CONNECTIONS

- A. Ground electric units according to Electrical Section "Grounding and Bonding."
- B. Connect wiring according to Electrical Sections "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Testing: Perform the following field tests and inspections and prepare test reports:
 - 1. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and units.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 23 83 33

SECTION 26 01 00
GENERAL PROVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. The specifications for the project basic electrical requirements.
- B. The Contractor to provide items, articles, materials, operations and methods required by the Drawings and Specifications including labor, equipment, supplies and incidentals necessary for completion of the Work under this Contract.
- C. Any incidental accessories necessary to make the work complete and ready for operation, even though not specified or shown on the Drawings to be furnished and installed without additional expense to the Contract.
- D. Should there be any discrepancies or a question of intent, the Contractor to refer the matter to the Authority for decision before ordering any equipment, materials or before starting any related work.
- E. The Contractor to furnish, erect, install, connect, clean, adjust, test and condition all manufactured articles, materials and equipment, and place in service in accordance with the equipment manufacturer's directions and specifications except as otherwise specified herein.

1.03 RELATED WORK

- A. The GENERAL PROVISIONS specified to be furnished and installed herein have related work in various other sections, including but not limited to:
1. Division 23 "Heating, Ventilating and Air Conditioning (HVAC)"
 2. Section 260300 "Electrical Demolition"
 3. Section 260500 "Raceways and Boxes"
 4. Section 261000 "Basic Electrical Materials and Methods"
 5. Section 261230 "Wires, Cables, Splices, Terminations"
 6. Section 261410 "Wiring Devices"
 7. Section 261700 "Local Control"
 8. Section 261750 "Local Control Panels"
 9. Section 261900 "Grounding"
 10. Section 261950 "Identification"
 11. Section 262116 "Electrical Utility Service"
 12. Section 263353. "Uninterruptible Power Supply"
 13. Section 262510 "Automatic Transfer Switch"
 14. Section 264000 "Service Equipment"
 15. Section 264600 "Dry Type Transformers"
 16. Section 264700 "Panelboards"
 17. Section 264900 "Generator Tap Box"
 18. Section 265010 "Lighting Fixtures"
 19. Section 265560 "Light Emitting Diode"
 20. Section 266000 "Concrete for Electrical Work"
 21. Section 267500 "Cabinet and Terminal Strips"

- 22. Section 267700 "Infrared Heating"
- 23. Section 269500 "Electrical Testing"

1.04 SUBMITTALS

- A. As soon as practical and within thirty days after award of contract and before any material or equipment is purchased, the Contractor to submit to the Authority for approval one electronic DVD and one electric PDF copy of all shop drawings to be incorporated in the work.
- B. Shop drawings to include manufacturers' names, catalog numbers, cuts, diagrams and other such descriptive data as may be required to identify and approve the equipment.
- C. Extended time for submitting special shop drawing may be requested; however, an extension of time approved does not relieve this Contractor of the responsibility of executing the work in accordance with the Contract.
- D. Any listed materials, fixtures, apparatus, or equipment that are not in accordance with the Specification requirements can and will be rejected for use in this installation and construction.
- E. Any materials, fixtures, apparatus or equipment installed without stamped or written approval to be removed by the Contractor and replaced with specified equipment at the direction of the Authority and without recourse for additional compensation.
- F. Substitutions to listed acceptable manufacturers equipment and material must be submitted for approval in advance.

1.05 INFORMATION SUBMITTALS

- A. Pre-Installation Submittals of the following types are required for the listed categories.
 - 1. Shop Drawings are required for the following.
 - a. Equipment details for switchgear, panelboards, transformers, etc.
 - b. Special systems for fire alarm, public address, security, etc.
 - c. Lighting fixtures for custom and non- standard design.
 - 2. Catalog Cuts are to cover common materials and supplies such as conduit, wire, devices, manufacturer's standard lighting fixtures, etc.
 - 3. Installation drawings are to cover equipment, materials supplies where installation is not adequately detailed on the Contract Documents. Provide the electrical room conduit and equipment layout to be provided.
 - 4. The equipment manufacturers wiring diagrams are to show terminal blocks for external wiring.
 - 5. The equipment manufacturers internal point to point and external wiring diagrams between cubicles, panels and components within the equipment line up are to be provided.
 - 6. Complete rating data for all equipment to be provided.
 - 7. Instruction books, operation and maintenance manuals with spare parts manuals are to be provided.
- B. Post construction submittals are required for the following types of documents.
 - 1. Shop drawing installation drawings are to be updated to "Record Document" status.
 - 2. Record Documents are to indicate the actual "as installed" status of all

equipment, controls and materials incorporated into the facility.

3. Test data to be provided for all equipment and wiring as required by various sections of these Specifications.
4. Instruction books, operations and maintenance manuals, spare parts lists are to be provided for all equipment and special systems.

C. Installation Drawings:

1. In addition to the preparation and submittal of Shop Drawings for manufactured electrical equipment and materials, the Contractor is to prepare and maintain in current status, a complete set of detailed, completely circuited, and dimensioned electrical construction drawings for all electrical work included under this Contract. These drawings to be made at the Contractor's expense and to be made on Mylar.
2. The installation drawings to be made under the direction and supervision of the Contractor to show all electrical work inclusive of conduit, wiring, electrical equipment and devices, lighting fixture locations and elevations, points where conduit enters or leaves structural slabs and walls, junction boxes, conduit supports and inserts. Symbol representation for home run circuits will not be acceptable.
3. The Contractor to provide a separate set of installation drawings for the lighting system; a separate set of installation drawings for the power and control; and a separate set of installation drawings for the special systems.
4. The complete electrical distribution system from source or sources up to and including each branch circuit panelboard to be shown and dimensioned exactly as installed, with all feeders located on the Drawings. Major equipment, lighting controls and apparatus are to be shown to scale and properly located; conduit home runs are not acceptable.
5. The installation drawings are to include floor plans and reflected ceiling plans with electrical layouts drawn at a scale (or scales) as required with a minimum scale of 1/8 inch equal 1 foot, 0 inches. It is intended that installation drawings of each trade be the same scale(s) in order to permit respective plans to be superimposed upon all others of each trade.
6. In addition to the floor plans, the layouts of all congested areas such as mechanical and/or electrical equipment rooms, and all functionally critical areas are to be drawn at a minimum scale of 1/4 inch equals 1 foot, 0 inches, and with all details of construction shown. The Authority may request additional installation drawings if in their opinion they are required to properly coordinate the project.
7. The installation drawings are to include schedules for all panelboards. Schedules are to depict the bus arrangement of the panelboard, the size of all circuit breakers, the connected load on each breaker, and a description of the load and it's location.
8. All installation drawings are to be made on 3 mil mylar sheets of the same size and with the same border lines and title blocks as the Contract Drawings, with the Contractor's name added.
9. The Contractor is to be responsible for the coordination of electrical work with the work of all other trades and to, in preparing the installation drawings, continually check the work of all other trades (inclusive of that indicated by shop drawings) in order to avoid possible installation conflicts arising. It is understood that the work shown on the installation drawings has been so coordinated. In the event of conflicts or interferences that cannot be resolved in the field, the Contractor is to request a written clarification from the Authority.
10. The installation drawings are to indicate the electrical installation exactly as constructed and therefore to be periodically revised to reflect all changes inclusive of those required by the Authority, those which are or have been found necessary in the field, those which may be suggested by the Contractor and approved by the Authority, etc.

11. Conduits are to be shown on the installation drawings as installed. Conduit home runs are not acceptable.
12. Revisions are to be performed when considered necessary by the Authority or the Contractor in order to facilitate proper coordination, but are to in no event be performed at interim periods exceeding 30 days between each such revision.
13. The initial copy of all installation drawings are to be submitted to the Authority for review. These submittals are to be considered as shop drawings and are subject to the shop drawing approval process. Subsequent revised copies are to be issued to the Authority as requested. It to be clearly understood that these installation drawings are for installation coordination purposes only and cannot in any way alter the requirements of the Contract. Therefore, the Drawings, Specifications, and authorized revisions thereto, are to remain the only determinants of the Contract requirements.
14. Upon completion, the initial installation drawings, and all revised installation drawings thereafter, it is to be dated and certified by the Contractor as having been fully coordinated. It is then to be understood that the work shown thereupon is ready for construction.
15. No electrical work is to begin until these installation drawings (and each revision thereof) are so drawn, and thereafter finally accepted by the Authority.
16. All installation drawings are to be made in accordance with an approved schedule, prepared by the Contractor, and arranged to coincide with actual construction in such a manner as to allow the latter work to proceed without delay.
17. If, in the opinion of the Authority, the installation drawings are in acceptable condition after each has been finally revised and accepted, the Contractor may submit same as the field record drawings called for elsewhere in the Specifications.
18. The Contractor is to include wiring diagrams and schematic diagrams. Each schematic diagrams are to be "JIC" ladder type. Wire numbers are to be shown on all schematic and wiring drawings.
19. The minimum drafting letter size is to be 1/8 inch in height, block style.

D. The Contractor is to submit test reports as described under this Contract.

1.06 QUALITY ASSURANCE

- A. Materials and installation to conform to the applicable Codes and Standards.
- B. After all equipment, devices and raceways are installed and wires and cables are in place and connected to devices and equipment, the Contractor to test the system for continuity, proper phase rotation, short circuit, improper grounds, and other defects. If any defective conditions are present, the Contractor to make all necessary corrections and retest for compliance.
- C. Each major component of equipment to have the manufacturer's name, address, model number and rating on the manufacturer's nameplate securely affixed in a conspicuous place.
 1. The nameplate of a distributing agent is not acceptable.
 2. Code ratings, labels or other data, including any that are die-stamped into the surface of the equipment, to be in a visible location.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Equipment and materials to be delivered to the site and stored in original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.

1. Items subject to moisture damage to be stored in dry heated spaces.
 2. Manufacturer's directions to be followed in the delivery, handling, storage, protection, installation and operation of all equipment and materials.
- B. The Contractor to determine, from examination of the Drawings, whether any special temporary openings in the building will be required for the admission of apparatus furnished under this section, and notify the Authority accordingly. In the event of failure to give sufficient notice in time to arrange for these openings during construction, the Contractor to assume all costs of providing such openings thereafter.
- C. The Contractor to coordinate with the Authority the movement of heavy machinery, equipment and heavy parts thereof brought into or onto the building or premises.
- D. Conduit openings to be kept closed by means of plugs or caps to prevent the entrance of foreign matter.
- E. The Contractor to cover all fixtures, equipment and apparatus as required to protect them against dirt, water, chemical, solar, or mechanical damage. The Contractor to also provide any supplementary heating and cooling required to prevent moisture and thermal damage.
- F. Equipment to be inherently safe and moving parts are to be covered with guards.
- G. Equipment in storage having moving parts, which may be damaged or distorted by being idle, to be rotated or exercised periodically and all lubricants to be properly maintained.

1.08 CODES AND STANDARDS

- A. Materials and installation to comply with codes, laws and ordinances of Federal, State, and Local governing bodies having jurisdiction.
- B. In every installation where regulations of electric utility and telephone companies apply, conformance with their regulations to be mandatory and any costs incurred to be included in the Contract.
- C. In case of differences between building codes, State and Federal laws, local ordinances and utility companies regulations and the Contract Documents, the most stringent to govern.
- D. All equipment and materials purchased for this Project to conform to any acts, laws, rules and regulations of the following organizations:
1. City of Chicago Electrical Code (CEC) to take jurisdictional precedence over all other authoritative bodies.
 2. National Electrical Safety Code (NESC-ANSI C2).
 3. American National Standards Institute (ANSI).
 4. National Fire Protection Association (NFPA).
 5. Institute of Electrical and Electronics Engineers (IEEE).
 6. Insulated Cable Engineers Association (ICEA).
 7. National Electrical Manufacturers Association (NEMA).
 8. Illuminating Engineering Society (IES).
 9. Underwriters Laboratories Inc. (UL).
 10. Canadian Standards Association (CSA).
 11. Occupational Safety and Health Administration (OSHA).
- E. Should Work be performed which does not comply with the requirements of the

applicable building codes, State and Federal laws, local ordinances, industry standards and utility company regulations, changes for compliance to be done at no additional cost to the Contract.

- F. The Contractor to secure and pay for all required permits, governmental fees, taxes and licenses necessary for the proper execution and completion of the Electrical Work.
- G. The Contractor to submit to governmental agencies and utility companies any shop drawings for equipment, which require their approval.
- H. The Contractor to notify the Authority of any proposed materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction.

1.09 DRAWINGS

- A. The Drawings are diagrammatic and are intended to convey the scope of work and indicate the general arrangement and/or sizes of conduit, equipment, fixtures and other work included in the Contract.
- B. The location of items required by the Drawings or Specifications where not definitely fixed by dimensions on the Drawings are approximate only. The exact locations necessary to secure the best conditions and results are to be determined at the site and are to be subject to the approval of the Authority.
- C. The Contractor to coordinate the location of the lighting fixtures and intercommunication speakers with the location of the mechanical equipment.
- D. The Contractor to lay out the work, check drawings of other trades to verify spaces in which work to be installed, and maintain maximum headroom and space conditions at all points.
 - 1. Where headroom or space conditions appear inadequate, the Contractor is to notify the Authority before proceeding with installation.
 - 2. Any minor changes in the locations of equipment, fixtures, lighting fixtures conduits, outlets, devices, etc., from those locations as shown on the Drawings is to be made without extra cost to the Contract. A minor change in location to be considered is to be within 10'-0" of the location as may be scaled from the Drawings for all interior work and within 25'-0" for all exterior work.

1.10 EXECUTION, CORRELATION AND INTENT OF DOCUMENTS

- A. In the event that conflicts, if any, cannot be settled rapidly and amicably between the affected trades, with the Work proceeding in a workmanlike manner, then the Authority to decide which Work is to be relocated. The Authority's judgment to be final and binding on the Contractor.
- B. No measurements of a Drawing by scale to be used as a definite dimension to work by.

1.11 INSTRUCTIONS AND ADJUSTMENTS

- A. At the conclusion of the Work and before final contract payment is made, the Contractor to demonstrate and explain to the Authority the function, operation and maintenance of all equipment and systems installed.
- B. The primary adjustments of the system(s) to be accomplished by the Authority to the complete satisfaction of the Authority at the time of completion of the installation.

1.12 GUARANTEE

- A. The Contractor to be responsible for all Work in this Specification. The Contractor to make good, repair, or replace at his own costs and expense as may be necessary, any defect which in the opinion of the Authority is due to imperfections in material, design or workmanship or if defect shows itself to be defective within one year after acceptance by the Authority.
- B. The Contractor to be responsible for protecting all equipment and systems against harmful exposures to, or accumulations of dust and moisture, flooding, corrosion or other forms of damage and to clean and restore damaged finishes as may be required to place installations in a "Like New" condition before acceptance by the Authority.
- C. All manufacturers' equipment guarantees or warranties to be included in the Maintenance Manuals.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment to be new and to be UL or CSA labeled where applicable and to bear the manufacturer's name, model number and other identification markings.
- B. Materials and equipment to be the standard product of a manufacturer regularly engaged in the production of the required type of material or equipment for at least five years (unless specifically exempted by the Authority and to be the manufacturer's latest design with published properties that meet the specification requirements.
- C. Equipment and materials of the same general type to be of the same manufacturer throughout the project to provide uniform appearance, operation and maintenance.
- D. Equipment and materials to be without blemish or defect and to not be used for temporary light or power purposes, including lamps, without the Authority's written authorization.

2.01 ENCLOSURES FOR ELECTRICAL EQUIPMENT/FITTINGS

- A. Enclosures for Electrical Equipment to be governed by the area classification described below or unless otherwise noted on the Drawing.
- B. NEMA Type 1A may be used in dry indoor environmental with full time filtered air supplies.
- C. NEMA Type 12 to be used in indoor dry and non-chemical environment.
- D. NEMA Type 13 oil tight devices to be used for all control panels.
- E. NEMA Type 4X stainless steel to be used in exterior, interior wet areas, and corrosive environment where chemicals are stored or mixed with liquids or as indicated on the Contract Drawings.
- F. NEMA Type 7/9 hazardous, to be used in all hazardous areas.
- G. Specific site requirements may necessitate the use of different enclosure ratings.

2.02 MOTOR VOLTAGE OPERATION

- A. Unless otherwise noted, all AC motors to be operated on the following voltages:
 - 1. Motors under 1/2 horsepower to be 115 volts AC, single phase, 60 Hertz.
 - 2. Motors 1/2 horsepower and larger to be 208 volts AC, 3 phase, 60 Hertz.
- B. AC motor type, enclosure type, and other design requirements to be as specified in these Specifications.

PART 3 EXECUTION

3.01 INSTALLATION OF WORK

- A. The Contractor shall perform all Work with trained mechanics of the particular trade involved in a neat and workmanlike manner as approved by the Authority.
- B. The Contractor shall perform all Work in cooperation with other trades and schedule to allow speedy and efficient completion of the Project.
- C. The Contractor shall furnish other trades with advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit trades affected to install their work properly and without delay.
- D. Where there is evidence that the work of one trade will interfere with the work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments and shall be prepared to submit and revise coordinated shop drawings and installation drawings.
- E. With the approval of the Authority and without additional cost to the Contract, the Contractor shall make minor modifications in the Work as required by structural interferences, by interferences with work of other trades or for proper execution of the Work.
- F. Minor changes in the locations of outlets, fixtures and equipment shall be made at the direction of the Authority prior to rough-in and shall be at no additional cost to the Contract.
- G. The equipment shall be installed with ample space allowed for removal, repair or changes to equipment. Ready accessibility to removable parts of equipment and to wiring shall be provided without moving other equipment which is to be installed or which is in place.
- H. Locations of electrical outlets, lighting panels, cabinets, equipment, etc. are approximate and exact locations shall be determined by the Contractor at the Project site.
- I. The Contractor shall refer to the Contract Documents for details and reflected ceiling drawings.
- J. The Contractor shall protect the materials and work of other trades from damage during installation of the work provided under this Contract.
- K. Noise levels of electrical devices and equipment shall be within acceptable limits as established by NEMA or other valid noise rating agencies. Noise levels shall be subject to the Authority's acceptance which will be based on practical and reasonable

considerations of occupancy requirements.

- L. The Contractor shall check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration and chatter under normal conditions of use.
- M. When located elsewhere than in high-noise-level equipment rooms, the enclosures or solenoid-operated switching devices and other noise-producing devices shall have anti-vibration mountings and non-combustible sound-absorbing linings.
- N. Transformers, reactors, dimmers, lamp ballasts, and solenoids shall be designed and rated for "quiet" design.
- O. The Contractor shall remove and replace any individual electrical item or device that is found to produce a sound energy output exceeding that of other identical devices installed at the Project.

3.02 TRANSMISSION OF VIBRATION

- A. Electrical equipment, conduit, and fittings shall not be mounted to or supported by elements subject to vibration except by methods specified here in and/or shown on the Drawings.
- B. Where flexible conduit lengths are utilized as a means of isolating equipment and conduit systems vibration, care shall be exercised to assure continuity of ground throughout. Flexible conduit lengths shall be a maximum of 18 inches in areas where same are permitted.

3.03 PROTECTION

- A. The Contractor shall protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps.
- B. The Contractor shall cover fixtures, materials, equipment and devices furnished or installed under this Contract or otherwise protect against damage, before, during, and after installation.
- C. Fixtures, materials, equipment, or devices damaged prior to final acceptance of the Work shall be restored to their original condition or replaced.
- D. Equipment shall be inherently safe and moving parts shall be covered with guards.

3.04 INSTALLATION OF WORK FOR OTHER SECTIONS

- A. The Contractor shall coordinate all electrical work and shall complete all wiring, conduit, material and electrical equipment as required for equipment installed under other divisions of these Specifications.

END OF SECTION 26 01 00

SECTION 26 03 00
ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

A. Section Includes:

1. Work required for this Section includes providing all labor, material, apparatus, equipment and services necessary to disconnect and remove electrical items which are affected by or rendered obsolete by demolition work.
2. Major items with all related appurtenances, which are rendered obsolete and require removal in the areas being demolished, include but are not limited to, the following:
 - a. Service equipment.
 - b. Lighting fixtures.
 - c. Wiring devices.
 - d. Conduits and raceways.
 - e. Outlet boxes.
 - f. Wire and cable from source to point of use.
3. All material, equipment, damaged items, conduit and wire rendered obsolete shall be removed from the premises and properly disposed of off site by the Contractor.
4. Items being removed which are salvageable and serviceable (such as lighting fixtures, wiring devices, signal and telecommunication devices) shall remain the property of the Authority and to be stored by the Contractor in locations on site where directed by the Authority. Items of doubtful classification shall be reviewed with the Authority's representative prior to disposal of same to determine their disposition. Care shall be exercised in the removal of these items to avoid damage.
5. Relocation and/or modifications to certain existing equipment may be required to retain services to existing adjacent systems or equipment which are to remain. Such relocation and/or modification costs to be included in the Base Bid and no additional compensation will be allowed.
6. Include providing new conduit, wiring, boxes, outlets, fittings, etc. as may be required for such relocation and retention of services.
7. Existing conduits concealed in slabs which are rendered obsolete shall be cut off flush with the surfaces and plugged with foam. Foam sealant shall be as manufactured by GE, Dow, or 3M.
8. Existing recessed boxes in concrete columns or walls which are to remain shall be filled with foam and provided with suitable blank covers. Foam sealant shall be as manufactured by GE, Dow, or 3M.

B. Related Sections:

- | | | |
|-----|----------------|--|
| 1. | Section 260100 | "General Provisions" |
| 2. | Section 260500 | "Raceways and Boxes" |
| 3. | Section 261000 | "Basic Electrical Materials and Methods" |
| 4. | Section 261230 | "Wires, Cables, Splices, Terminations" |
| 5. | Section 261410 | "Wiring Devices" |
| 6. | Section 261700 | "Local Control" |
| 7. | Section 261750 | "Local Control Panels" |
| 8. | Section 261900 | "Grounding" |
| 9. | Section 261950 | "Identification" |
| 10. | Section 264700 | "Panelboards" |
| 11. | Section 265010 | "Lighting Fixtures" |
| 12. | Section 269500 | "Electrical Testing" |

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL CONDITIONS

- A. Visit the Project Site and thoroughly investigate existing conditions. Carefully evaluate all existing Electrical Work which is to be removed, altered or modified, and include all these costs in the Bid. Determine existing installation
- B. Work which is to remain to serve areas outside the limits of demolition Work and include all costs of relocation Work which may be required to retain these services. No additional costs will be allowed for failure to include all labor and material that is required for demolition, relocation or modification to the existing electrical installation. If any potential problems are envisioned during the site visit which could affect the Work to be done, they shall be brought to the immediate attention of the Authority.
- C. Electrical demolition shall be done according to the schedule established for general demolition work to eliminate any conflicts, interferences or delays.
- D. Exercise care in demolition work so as not to damage or interrupt existing services which may pass through the areas of demolition and serve areas outside the demolition work areas which are to remain.

END OF SECTION 26 03 00

SECTION 26 05 00
RACEWAYS AND BOXES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section specifies all raceways and boxes as well as appurtenances thereto required under Division 26.
- B. Related work specified elsewhere:
- | | | |
|-----|------------------|--|
| 1. | Section 26 01 00 | General Provisions |
| 2. | Section 26 03 00 | Electrical Demolition. |
| 3. | Section 26 10 00 | Basic Electrical Materials and Methods |
| 4. | Section 26 12 30 | Wires, Cables, Splices, Terminations. |
| 5. | Section 26 14 10 | Wiring Devices. |
| 6. | Section 26 17 00 | Local Control |
| 7. | Section 26 17 50 | Local Control Panels |
| 8. | Section 26 19 00 | Grounding |
| 9. | Section 26 19 50 | Identification |
| 10. | Section 26 47 00 | Panelboards |
| 11. | Section 26 50 10 | Lighting Fixtures |
| 12. | Section 26 95 00 | Electrical Testing |

PART 2 PRODUCTS

2.01 RACEWAYS AND BOXES

- A. General:
1. All wire and cable shall be installed in electrical raceways of the type specified herein and shown on the Drawings.
 2. Minimum size conduit shall be 3/4 inch for RGS, 1-1/2 inch for fiberglass.
 3. Acceptable manufacturers for conduit, boxes and other electrical devices shall be Appleton, Crouse-Hinds, O-Z/Gedney or an approved equal.
- B. Galvanized Rigid Steel Conduit:
1. Galvanized rigid steel (GRS) conduit and fittings shall be installed in all above ground areas of this Project except as noted herein.
 2. GRS conduit shall be heavy wall type, hot-dipped galvanized with zinc-coated threads, and Underwriters' Laboratory labeled.
 3. GRS conduit and couplings shall be threaded, rigid steel, hot-dipped galvanized after fabrication and shall be in accordance with UL 6.
- C. Intermediate metal conduit (IMC) is not acceptable.
- D. Rigid Non-Metallic Conduit:

1. Non-metallic rigid conduit shall be used for underground feeders, service feeders, and under concrete slabs on grade.
 2. Non-metallic rigid conduit shall be of the fiber glass reinforced epoxy type, minimum size of 1-1/2 inches in diameter.
 3. Fiber glass conduit shall be composed of glass filament encapsulated in an epoxy matrix. Each conduit length shall have an integral wound in expanded coupling. No threads or adhesives shall be required to assure watertight joints for underground installations.
 4. Conduit shall be suitable for continuous operation from minus 40 degrees C to plus 100 degrees C without significant change of mechanical properties. Conduit shall be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for UV protection.
 5. Conduit shall be UL listed.
- E. Liquid-Tight Flexible Metal Conduit:
1. Liquid tight flexible metallic conduit shall be used for termination at recessed light fixtures, in non-plenum ceilings, motors, transformers, and installations subject to vibration.
 2. Liquid-tight galvanized steel flexible conduit shall conform to UL 360. Fittings shall be of a type designed to provide a liquid-tight continuation of the conduit system.
- F. Liquid Tight Flexible Metal Tubing:
1. Liquid tight flexible metal tubing shall be used for termination at recessed light fixtures, in plenum ceilings.
 2. Liquid tight metal flexible metal tubing shall conform to UL 360, Fittings shall be of a type designed to provide liquid-tight continuation of the conduit system.
- G. Conduit Fittings:
1. Galvanized Rigid Steel Conduit:
 - a. All fittings shall be; malleable iron; threaded type; hot dip galvanized or cadmium plated. Feraloy, aluminum, or threadless fittings are not acceptable and shall not be provided.
 - b. All LB, LR, and LL fittings shall have detachable cover, captive brass machine screws, and full neoprene gasket. All LB, LR and fittings shall be NEC Series Mogul Type.
 - c. Locknuts shall be malleable iron or steel, with non-slip notches.
 - d. All bushings shall be of the insulated and grounding type.
 - e. Expansion couplings shall have capability of eight inch movement and be complete with flexible bonding jumper.
 2. Rigid Non-Metallic Fiberglass Reinforced Epoxy Conduit:
 - a. All fittings shall be composed of glass filaments encapsulated in an epoxy matrix.
 - b. All fittings shall be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for ultra-violet protection.
 - c. All fittings shall be suitable for continuous usage in ambient temperatures ranging from minus 40 degrees C to plus 100 degrees C without significant change of mechanical properties.
 - d. Fittings in all sizes shall have inside diameters equal to the trade sizes.

3. Liquid-tight Flexible Metallic Conduit:
 - a. All fittings for use with liquid-tight flexible metallic conduit shall require the use of a wrench during installation.
 - b. All fittings shall; have a deep grip ferrule for thorough engagement of the flexible conduit and grounding continuity; provide high resistance to pull out of the flexible conduit from the fitting; withstand extreme external flexing, vibration and moist environments.

H. Conduit Hangers and Supports:

1. The Contractor shall provide all necessary conduit hangers, and equipment supports or hangers, including all structural steel members and shapes, standard rods, nuts, bolts, concrete inserts, expansion shells, pipe brackets, tubing and conduit clamps, as indicated, hereinafter specified, or as required to support and/or suspend all equipment and conduit.
2. Exposed conduit on walls or ceilings shall be supported, a minimum of every five feet, with galvanized malleable iron one hole clamps and matching backs, utilizing anchors as specified herein.
3. For concrete or brick construction, when stray current isolation is not required, insert anchors to be zinc alloy steel or steel anchors as manufactured by Ackerman-Johnson, Paine or Philips with non-corroding round head machine screws.
4. For wood construction provide galvanized round head wood screws.
5. For exposed work, where two or more conduits, one inch or larger are run parallel, trapeze hangers, spaced on five foot centers may be used.
6. The Contractor to secure fasten conduits to each support with U-bolts, or conduit straps. Conduit supports to be as manufactured by B-Line, OZ/Gedney, Unistrut Corp., or approved equal. Supports to be held to concrete walls and ceilings by electro-galvanized steel inserts as manufactured by B-Line, Ramset, Unistrut Corp., or approved equal. Supports suspended from steel structure to be supported from drilled holes in the steel flange. The use of beam clamps for this work is not acceptable.
7. The Contractor to provide hanger rods for trapeze-type hangers made from high tensile strength carbon steel not less than 1/2-inch diameter. The rods to have free-running, burr-free Unified National Coarse threads, with an electro-galvanized finish. Conduit supports to be located at intervals not exceeding 5 feet as required by City of Chicago Electrical Code.
8. For exposed work attached to the support structure of the Rapid Transit right of way, conduits to be supported as shown on the Drawings. The use of beam clamps, and or trapeze type hangers for this work is not acceptable.
9. The use of explosive force, hammer actuated, booster assist, piston drive, or like devices is strictly prohibited.
10. The use of perforated strap hangers, plastic, or composition inserts is not acceptable.
11. The Contractor to support vertical conduits by heavy wrought iron clamps or collars anchored in construction at each floor.
12. Where threaded fasteners are provided, either a jam nut or aerobic thread sealant manufactured by Loctite or approved equal to be used.

I. Outlet, Junction and Pull Boxes:

1. Outlet boxes, shall be hot dipped galvanized sheet steel or cast ferrous metal conforming to UL 514, suitable for use in damp areas.
2. Outlet boxes installed outdoors, on, or under the platform, shall be cast iron type with a cast or malleable iron gasketed cover.

3. Junction and pull boxes shall be constructed of galvanized sheet steel, with continuously welded seams, and shall be hot dipped galvanized after construction. or cast Ferrous metal conforming to UL 50.
4. The size shall be as shown on the Drawings or required by the NEC and Chicago Electrical Code.

J. Cable Trays:

1. Cable trays shall be of the ventilated, steel ladder type with 9 inch rung spacing. Trays shall have the depth and width as specified, required or shown on the Contract Drawings. All components of the tray system shall be of the same design and manufacture.
2. Cable trays and accessories shall conform to NEMA Standard VE 1 and shall be hot dipped galvanized after fabrication.
3. Cable trays shall have minimum load rating of 50 pounds per linear foot with safety factor of 1.5 at 12-foot support span.
4. Fittings in cable trays system shall have a minimum radius of 24 inches for both vertical and horizontal turns.
5. Trays and fittings shall be of Ventray Design as manufactured by B-Line Systems, Chalfant Mfg Co., MP Husky Corp. or approved equal.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATIONS

A. General:

1. All conduits shall be installed as required. The conduit system shall be installed complete with all accessories, fittings, and boxes, in an approved and workmanlike manner to provide proper raceways for electrical conductors.
2. All conduit runs shown on the Drawings are shown diagrammatically for the purpose of outlining the general method of routing the conduits. Conduit shall be run underground or in concrete slabs only when shown on the Drawings. It shall be the Contractor's responsibility to avoid interferences.
3. Exposed conduit runs shall be installed true, plumb, parallel with or at right angles to adjacent structural members, and must present an orderly, neat and workmanlike appearance.
4. Factory-made conduit bends or elbows shall be used wherever possible in making necessary changes in direction. Field bends shall be made with proper tools for the size and type of conduit being used. Field bends shall be carefully made to prevent conduit damage or reduction in internal areas. The bending radius shall not be less than six times the nominal diameters of the conduit, with carefully matched bends on parallel runs to present a neat appearance. The number of crossovers shall be kept to a minimum.
5. All conduit cut on the job shall be carefully reamed after threading, to remove burrs. All field cut threads shall be tapered. No running threads will be permitted. Field cut threads on steel conduit shall be given a coat of zinc dust in oil, or other approved compound.
6. All threaded joints shall be watertight and ensure a low resistance ground path in the conduit system.
7. All conduits shall be carefully cleaned before and after installation and all inside surfaces shall be free of imperfections likely to injure the cable. After installation of complete runs, all conduits shall be snaked with an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Any conduits through which the mandrel will not pass shall be removed and replaced. After snaking, the ends of

- the dead-ended conduits shall be protected with standard malleable metal caps to prevent the entrance of water or other foreign matter.
8. Lines of nylon or polypropylene, propelled by carbon dioxide or compressed air, shall be used to snake or pull wire and cable into conduits. Flat steel tapes or steel cables may be used for branch circuit runs less than 50 feet long.
 9. Where conduits are connected to boxes or equipment enclosures, drilled holes or full size knockout openings shall provide electrical continuity for grounding and shall be assured by the use of bonding type locknuts. Where connections are at eccentric or concentric knockouts, jumper type grounding bushings and wire jumpers shall be installed.
 10. At pull and junction boxes that have any dimension in excess of 18 inches and having a total of more than four conduit terminations, jumper type grounding bushings shall be installed on conduit ends and jumper wires shall be installed to bond all conduits and to bond conduits to boxes.
 11. Communication conduit radius shall not be less than 10 conduit diameters.
 12. Conduit bends which are crushed or deformed in any way shall not be installed.
 13. Conduit systems shall be installed, with fittings, double locknuts and bushings, and made up tight to insure ground continuity throughout the system.
 14. Conduit connections to enclosures located in exterior areas, interior wet areas or subway areas shall terminate in a threaded hub with an insulated throat to provide a positive seal, an electrical ground and a water tight connection. Each hub shall be manufactured by Meyers, OZ/Gedney Type CH-T, or approved equal.
- B. As far as practicable, conduit shall be pitched slightly to drain to the outlet boxes, or otherwise installed to avoid trapping of condensate. Where necessary to secure drainage, a breather-drain fitting, shall be installed in the boxes or trapped conduit at low points. Each breather drain fitting shall be manufactured by Crouse-Hinds Co., Appleton Electric Co., or approved equal.
- C. Conduit shall not run through columns or beams unless so specifically detailed on the drawings.
- D. Conduit Installed in Concrete Slab
1. Metal conduits shall not be installed in concrete slabs on grade. Where installed in slabs, conduit shall be placed in the center of the slab and no closer than 3 diameters from adjacent conduits. The maximum outside diameter of conduits in the slab shall be no greater than 1/3 of the slab thickness.
 2. Joints in conduit installed in concrete slabs shall be made watertight.
 3. Conduit openings shall be temporarily plugged with metal caps to exclude water, concrete, plaster and other foreign material.
 4. Conduits run in earth below any floor slab shall be rigid non-metallic conduit and shall be entirely encased in reinforced steel concrete. In no case shall conduit be laid in fill below the slab.
 5. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during the placing of concrete.
 6. The Contractor shall be held responsible for proper position of conduits and shall rearrange any conduit that may be displaced while concrete is placed.
 7. Conduits run in floor slabs shall be a minimum one inch in size, and as shown on the Drawings.
- E. The number of 90 degree bends shall be limited to 3 or a total of 270 degrees including all offsets, sweeps, kicks, etc. This shall include conduit runs between panelboards, switchboards, pull boxes, outlets boxes, fittings, or between outlets and fittings including

bends located immediately adjacent to outlets or fittings. The maximum run without pull boxes shall be 150 feet.

- F. The Contractor shall furnish and install expansion fittings and bonding jumpers for the metallic conduit system where conduit crosses each building expansion joint, at each straight uninterrupted run of surface mounted conduit, or each vertical riser in excess of 100 feet and where conduits transfer between structurally independent buildings or supports. The distance between fittings as installed shall not exceed 200 linear feet.
 - 1. Expansion fittings shall provide for 8 inch movement and shall include bonding jumpers.
 - 2. Expansion fittings shall be Appleton XJ with XJB jumpers, Crouse-Hinds, OZ/Gedney, or approved equal.
- G. All wiring systems shall be "pullable" and use of "BX" is prohibited.
- H. Conduits entering motor control center conduit compartments, free standing panels, and free standing control cubicles shall be fitted with jumper type insulated grounding bushings, bonded together and to the structure of the enclosure by a continuous bonding wire.
- I. Conduits and concrete type boxes, masonry boxes, and other flush mounted boxes shall be installed concealed in masonry walls, plaster walls, dry wall and concrete walls.
- J. All concealed conduits shall be placed in walls, floors, ceilings, or ducts at the proper time, in accordance with the progress of the structural work.
- K. Concrete encased conduit runs extending through structural expansion joints shall have fittings permitting longitudinal and lateral movement of the conduit ends without damaging the contained wires. The fittings shall be watertight and include a grounding bond.
- L. Conduit runs that enter the building from outdoors are subject to moisture accumulation due to condensation. A pull box shall be provided in the conduit run near the point of temperature change, to prevent trapping of moisture within the conduit system. A 1/4 inch weep hole shall be drilled in the bottom of the pull box. After the wires and cables are installed, the end of the conduit continuing into the warmer area shall be packed with a non-setting sealing compound.
- M. All communication, telephone, data and computer conduits shall have a minimum separation of 12 inches from any AC power and control conduits.
- N. When work is not in progress, open ends of conduit and fittings shall be securely closed so that no water, earth or other substance will enter.

3.02 CONDUIT CONNECTIONS TO EQUIPMENT

- A. The conduit system shall be terminated at the conduit connection point of electric motors, devices, and equipment. Terminations of conduits at such locations shall permit direct wire connections to the motors, devices, or equipment.
- B. Conduit connections shall be made with rigid conduit if the equipment is fixed and not subject to adjustment, mechanical movement, or vibration. Rigid conduit connections shall have union fittings, to permit removal of equipment without cutting or breaking the conduit.

- C. Conduit connections shall be made with approved flexible metallic conduit if the equipment is subject to adjustment, mechanical movement, or vibration. Flexible conduit connections shall be watertight.

3.03 OUTLET BOX INSTALLATION

- A. Boxes shall generally be 4 inches square or octagonal except as follows:
1. In masonry walls, where conduit is installed concealed, each box shall be installed square cut masonry boxes.
 2. In concrete walls and floor slabs, where conduit is installed concealed, boxes shall be suitable and constructed for installation in concrete.
 3. In exposed work, surface outlet boxes shall be used for switches and receptacles.
 4. Outlet boxes for use with rigid conduit shall be of the threaded hub, malleable iron cast metal type, with malleable iron cast covers and gaskets.
 5. In finished plaster walls, drywall, etc., raised device covers on outlet boxes shall be provided.
 6. Where 1-1/4 inch conduits are required, the box size shall be a minimum of 4-11/16 inches square.
- B. Proper covers on boxes mounted flush shall be provided.
- C. All ceiling outlets shall have adequate supports and shall be equipped with adequate devices to carry and mount lighting fixtures provided fixtures do not weigh more than fifty pounds.
- D. An outlet box shall be provided at each device location requiring one.
1. Outlet box locations as shown on the Drawings shall be considered as approximate only.
 2. Exact locations shall be determined from the Drawings or from field instructions. The Contractor shall coordinate box locations with the work of other trades.
 3. Boxes shall be installed true and plumb, so that the covers or plates shall be level and at uniform elevations for the type of outlets contained.
 4. Boxes for toggle switches and pilot lights at doorways shall be located at the strike side of the door.
- E. There shall be no more openings made in any box than are required for the conduits entering same. Depths of boxes shall be such as to allow for easy wire pulling and proper installation of wiring devices.
- F. Switches and receptacles shall be ganged in a common box only where the Drawings so indicate.
- G. Device Boxes:
1. Recessed ceiling fixtures shall have 4 inch square sheet steel box with cover and suitable hanger bar. The box shall be secured to the ceiling suspension members not more than 1 foot from the fixture opening.
 2. Surface mounted ceiling fixtures, for plaster or dry wall ceilings, shall have 4 inch sheet steel octagon box with round opening plaster ring and suitable hanger bar with 3/8 inch fixture stud.
 3. Fixtures which weigh more than fifty pounds shall be supported independently of the outlet box.
 4. Surface mounted wall bracket fixtures (concealed conduit) shall have 4 inch square sheet steel box with plaster ring as required for the fixture.

5. Ceiling outlets and wall bracket outlets (exposed conduit) in dry locations shall have 4 inch sheet steel octagon box with 3/8 inch fixture stud.
 6. Outlet boxes on exposed conduit run in wet or damp locations shall have 4 inch cast box with threaded hubs and gasketed covers.
 7. Wall switch and receptacle boxes installed in tiled or plastered walls shall have 4 inch square sheet steel boxes or multi-gang boxes with proper tile or plaster ring as required. Two gang may be provided by means of 4 inch square box with two gang tile or plaster ring.
 8. Wall switch and receptacle boxes in dry locations in brick walls, unfinished walls, woodwork, etc. shall have single or multigang 4 inch square sheet steel boxes.
- H. Plaster rings shall have threaded ears and shall be of suitable depth for the application.
- I. The Contractor shall provide boxes with metal barriers, baffles or separators for grouping of dis-similar conductors or system separation.

3.04 PULL BOX INSTALLATION

- A. Pull boxes shall be installed where shown and where necessary to insure that finished cable will not be damaged.
- B. Pull boxes shall be supported independently from the conduit system.
- C. The Contractor shall add pull boxes where needed even though not shown on the Drawings.
- D. Cable Trays:
 1. The entire cable tray system shall be installed and supported by devices as shown on the Drawings. A system of preformed galvanized channel members may be used to support cable trays subject to the approval of the Engineer.
 2. To prevent fire from spreading between cable trays, the fire resistant blanket, "Flame-Safe" blanket manufactured by Thomas & Betts or approved equal and shall be installed as required whether or not it is shown. For control cable trays, fire resistant blanket shall be installed on top of the cable tray as shown.

3.05 FILLING OF OPENINGS

- A. Where conduit and raceway pass through interior fire-rated walls, ceilings or floors, the Contractor shall provide seals to prevent passage of fire and fumes and to maintain integrity of fire-rated structure.
- B. The Contractor shall close unused openings or spaces in floors, walls and ceilings, and plug or cap all unused conduit and sleeves.
- C. Where conduit passes through walls or floors which are below grade, the Contractor shall provide watertight sealing fittings, OZ/Gedney Type W5K, or Approved Equal.

3.06 IDENTIFICATION

- A. Conduit runs shall be identified as specified under Section 26 19 50 Identification.

3.07 FIELD QUALITY CONTROL

- A. The Contractor shall arrange with the Engineer for inspection and approval of embedded conduit and boxes prior to concrete placement.

- B. The Contractor shall test metallic conduit and boxes for electrical continuity. The tests shall be conducted in presence of the Authority.

END OF SECTION 26 05 00

SECTION 26 05 73
SHORT-CIRCUIT/COORDINATION & ARC FLASH STUDY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies short circuit and protective devices coordination studies, and arc flash studies to be provided by this contractor. Contractor must provide all labor, tools, equipment, software, and incidentals, as well as collect and prepare all data necessary to conduct and apply this study to the power distribution equipment as described herein.

1.03 RELATED WORK

- A. SHORT-CIRCUIT/COORDINATION & ARC FLASH STUDY specified to be furnished and installed herein have related work in various other sections, including, but limited to:

1. Section 261000 "Electrical General Provisions"
2. Section 261750 "Local Control Panels"
3. Section 262510 "Automatic Transfer Switch"
4. Section 263353 "Uninterruptable Power Supply"
5. Section 264000 "Service Equipment"
6. Section 264700 "Panelboards"
7. Section 264900 "Generator Tap Box".

1.04 REFERENCES:

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE Standard 1584 – 2002 Guide for performing arc flash calculation.

- B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

5. ANSI Z535.4 – Identify AFIE and appropriate Personal Protective Equipment Classes.

C. The National Fire Protection Association 70, National Electrical Code, latest edition.

1.05 SUBMITTALS FOR REVIEW/APPROVAL

- A. The short-circuit and protective device coordination, and arc flash studies must be submitted to the Authority prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing.

1.06 SUBMITTALS FOR CONSTRUCTION

- A. The results of the short-circuit and coordination, and arc flash studies must be summarized in a final report. Six (6) bound copies of the complete final report must be submitted.

B. The report must include the following sections:

1. One-line diagram
2. Descriptions, purpose, basis and scope of the study
3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.
5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
6. Results and recommendations of the arc flash analysis.
7. Recommendations for system improvements, where needed
8. Executive Summary.

1.07 QUALIFICATIONS

- A. The short-circuit and coordination, and the arc flash studies must be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer must be a full-time employee of the Engineer Services Organization.

PART 2 PRODUCTS

2.01 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination, and arc flash studies performed by equipment manufacturer.
- B. The study must be submitted to the Authority prior to receiving final approval on the electrical distribution equipment shop drawings. The result of the study must be included in the manufacturing of this equipment.
- C. Short circuit ratings indicated in the Contract Documents must be taken as nominal values for pricing purposes only. The Contractor and the equipment manufacturer must be responsible for implementing the recommendations of the study for a fully coordinated distribution system at no additional cost to the Authority.

2.02 DATA COLLECTION

- A. Contractor must furnish all data as required by the power system studies. The Engineer performing the short-circuit study and coordination study must furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor must expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future motors and utility sources.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by the Authority, or Contractor.
- D. Include fault contribution of existing motors in the study, with motors less than 100 HP grouped together. The Contractor must obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use typical conductor impedances must be based on IEEE Standards 141-1993
- B. Transformer design impedances must be used when test impedances are not available.
- C. Provide the following:
 - 1. Calculation methods and assumptions
 - 2. Selected base per unit quantities
 - 3. One-line diagram of the system being evaluated
 - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
 - 5. Typical calculations
 - 6. Tabulations of calculated quantities
 - 7. Results, conclusions, and recommendations
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
 - 1. Electric utility's supply termination point
 - 2. Incoming switchgear
 - 3. Automatic transfer switches
 - 4. Branch circuit panelboards
 - 5. Other significant locations throughout the system.
- E. Provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short circuit ratings
 - 2. Adequacy of switchgear, and panelboard bus bars to withstand short-circuit stresses
 - 3. Cable and busway sizes for ability to withstand short-circuit heating
 - 4. Notify Authority in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.04 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves must be graphically displayed on log-log scale paper.
- B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
- D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the curve sheets, where applicable:
 - 1. Electric utility's protective device
 - 2. Low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
 - 3. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
 - 4. Conductor damage curves
 - 5. Ground fault protective devices, as applicable
 - 6. Pertinent motor starting characteristics and motor damage points
 - 7. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.05 SHORT-CIRCUIT, PROTECTIVE DEVICE EVALUATION AND COORDINATION REPORT SECTIONS

- A. Input Data:
 - 1. Short-circuit reactance of rotating machines
 - 2. Cable and conduit materials
 - 3. Bus ducts
 - 4. Circuit resistance and reactive values.
- B. Short-Circuit Data:
 - 1. Source fault impedance and generator contributions
 - 2. X to R ratios
 - 3. Asymmetry factors
 - 4. Motor contributions
 - 5. Short circuit KVA
 - 6. Symmetrical and asymmetrical fault currents.
- C. Recommended Protective Device Settings:
 - 1. Phase and Ground Relays:
 - a. Current transformer ratio
 - b. Current setting
 - c. Time setting
 - d. Instantaneous setting
 - e. Specialty non-overcurrent device settings
 - f. Recommendations on improved relaying systems, if applicable.

2. Circuit Breakers:

- a. Adjustable pickups and time delays (long time, short time, ground)
- b. Adjustable time-current characteristic
- c. Adjustable instantaneous pickup
- d. Recommendations on improved trip systems, if applicable.

2.06 ARC FLASH HAZARD ANALYSIS

- A. The Arc-Flash Hazard Analysis must be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
- B. The Arc-Flash Hazard Analysis must be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
- C. Results of the Analysis must be submitted in tabular form, and must include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
- D. The analysis must be performed under worst-case Arc-Flash conditions, and the final report must describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- E. The Arc-Flash Hazard Analysis must be performed in compliance with IEEE Standard 1584-2002, the IEEE Guide for Performing Arc-Flash Calculations.
- F. The Arc-Flash Hazard Analysis must include recommendations for reducing AFIE levels and enhancing worker safety.
- G. The proposed vendor must demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least five actual Arc-Flash Hazard Analyses it has performed in the past year.
- H. The proposed vendor must demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
- I. The proposed vendor must demonstrate experience in providing equipment labels in compliance with NEC-2002 section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes. The Contractor must be responsible for verifying that proper warning labels have been applied to all required equipment.

PART 3 EXECUTION

3.01 FIELD ADJUSTMENT

- A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify the Authority in writing of any required major equipment modifications

END OF SECTION 26 05 00

SECTION 26 10 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 RELATED DOCUMENTS

- A. Related work specified elsewhere:

1.	Section 26 01 00	General Provisions
2.	Section 26 03 00	Electrical Demolition.
3.	Section 26 05 00	Raceways and Boxes.
4.	Section 26 12 30	Wires, Cables, Splices, Terminations.
5.	Section 26 14 10	Wiring Devices.
6.	Section 26 17 00	Local Control
7.	Section 26 17 50	Local Control Panels
8.	Section 26 19 00	Grounding
9.	Section 26 19 50	Identification
10.	Section 26 33 53	Uninterruptible Power Supply
11.	Section 26 47 00	Panelboards
12.	Section 26 50 10	Lighting Fixtures
13.	Section 26 95 00	Electrical Testing

PART 2 PRODUCTS

2.01 ACCESS PANELS

- A. Where items such as pull boxes, junction boxes, other specialties, or any piece of equipment or device requiring adjustment or service, are concealed in the construction, the Contractor shall furnish an access panel for ceilings or walls to permit adjustment or service of the concealed item. The access panel shall be of a design suitable for installation in the material forming the finished surface in which panel is mounted.
- B. Panels shall be flangeless hinged type with vandal-proof fasteners.
- C. Panels shall be furnished and installed under this Contract.
- D. Acceptable manufacturers shall be Crouse-Hinds, Miami-Carey Co., Milcor Division, Inland-Ryerson Co. Nystrom, Inc. or approved equal.

2.02 EQUIPMENT BASES

- A. The Contractor shall provide concrete pedestals, bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, hangers, channels, cradles, saddles, etc., for installation of all electrical equipment and apparatus that is floor mounted.
- B. Concrete pads shall be 4 inches high, unless otherwise indicated on the Drawings, complete with steel reinforcing and necessary bolts, anchors, etc. Where concrete pad is set directly on concrete floor, dowels in floor to tie base to floor shall be provided. These pads shall be extended at least 4 inches beyond the equipment outlined on all four sides, unless otherwise indicated on the Drawings.

2.03 VIBRATION ISOLATION

- A. Suspended vibration producing equipment shall have spring elements in the hanger rods or isolation pads under the equipment.
- B. Conduit connections to vibration producing equipment shall be made with flexible conduit.
- C. Acceptable manufacturers shall be Barry Division of Barry Wright Corp, Consolidated Kinetics Corp., Crouse-Hinds, Mason Industries or approved equal.

2.04 EXPANSION FITTINGS

- A. The Contractor shall furnish and install expansion fittings and bonding jumpers for the metallic conduit system where conduit crosses each building expansion joint, at each straight uninterrupted run of surface mounted conduit, at each vertical riser in excess of 100 feet and where conduits transfer between structurally independent pipes, poles or supports. The distance between fittings as installed shall not exceed 200 linear feet.
- B. Expansion fittings shall provide for 8 inch movement and shall include bonding jumpers.
- C. Expansion fittings shall be Appleton XJ with XJB jumpers, Crouse-Hinds, OZ/Gedney, or approved equal.

2.05 FLOOR BOXES AND FITTINGS

- A. Concrete tight floor boxes shall be pressed steel boxes with adjustable brass flange and covers. Acceptable manufacturers shall be Bell F 4052, Hubbell B 2529, or approved equal.
- B. Watertight floor boxes shall be cast iron with adjustable brass flange and covers. Close up plugs and reducing bushings shall be provided as required. Acceptable manufacturers shall be Bell F122-NR, Crouse-Hinds, Hubbell B 2537, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Interferences
 - 1. Locations of conduits, fixtures and equipment shall be adjusted and supported to accommodate field conditions encountered, including any potential interferences with other construction or equipment to be installed.
 - 2. The Contractor shall determine the exact route and location of each duct bank and electrical raceway prior to fabrication.
- B. Accessibility:
 - 1. The Work shall be installed to permit removal (without damage to other parts) of parts requiring periodic replacement or maintenance.
 - 2. Conduits and equipment shall be arranged to permit ready access to components and to clear the openings overhead doors and access panels.
 - 3. The Contractor shall provide necessary access panels in equipment as required for inspection and maintenance.
- C. Exterior Wall Openings:

1. Openings in exterior walls, particularly at or below grade, shall be kept properly plugged and caulked at all times to prevent the possibility of flooding due to storms or other causes.
2. After completion of the Work, openings shall be permanently sealed and caulked so as to provide leakproof conditions.

3.02 SLEEVES

- A. The Contractor shall provide sleeves where conduits pass through walls, floors, partitions.
- B. Sleeves shall be 18 gauge galvanized sheet metal or plastic, as approved by code, of sufficient length to finish flush with finished surfaces at both ends of sleeves.
- C. Sleeves shall be not less than 1 inch larger than outside diameter of conduit.
- D. Floor sleeves shall be galvanized steel or plastic pipe as approved by code, shall be of sufficient length to finish flush with the top and bottom of the floor, and shall be watertight.
- E. Sleeves through walls, ceilings, and floors, shall have the net openings packed with glass fiber insulation. Each sleeve shall be fire sealed to match the fire rating of the structure they penetrate. Both ends of the sleeves are caulked with waterproof mastic to prevent noise, dirt, air and water transmission.
- F. Where conduits pass through floors on grade or exterior walls, the Contractor shall provide watertight sealing fittings, OZ/Gedney Type WSK or approved equal.
- G. Sleeves shall be set true to line level plumb and shall be so maintained during construction. Where sleeve is provided in poured concrete, the Contractor shall inspect during and after concrete is poured, to insure proper position and to correct any deviation.

3.03 PAINTING (SEE SECTION 09 90 00)

- A. All electrical equipment not specified for factory finish painting under other sections of these Specifications shall be painted as specified herein.
- B. Prime Coat:
 1. Before delivery to the site, the shop fabricated and factory built equipment, which is not galvanized or protected by plating, shall be cleaned and given one shop coat of zinc-chromate primer before delivery to the site.
 2. Any portions of the shop coat damaged in delivery or during construction shall be recoated.
 3. Nameplates, labels, tags, stainless steel, or chromium-plated items such as motor shafts, levers, handles, trim strips, etc, shall not be painted.
- C. Finish Coat:
 1. Conduit and equipment shall be left cleaned and primed, ready for finish painting provided under the Painting section of this Specification.
 2. All equipment shall be factory finished in baked enamel or lacquer, or as specified. Standard finishes shall be approved. All scratches shall be touched-up by the Contractor.

3. All metal work installed by the Contractor exposed to weather and not factory finished shall be painted with one coat of red lead, and two coats of lead and oil paint of color selected by the Authority.

3.04 PATCHING

- A. The Contractor shall provide all cutting and patching of building materials required for the installation of the work herein specified.
 1. No structural members shall be cut without the approval of the Engineer.
 2. Roof deck is considered a structural member.
 3. Approved cutting shall be done with concrete saws or core drills.
- B. Patching shall be provided by mechanics of the particular trade involved and done in a neat and workmanlike manner.
- C. Slots, chases, and recesses with openings in the walls, ceilings, floors and roofs shall be provided by the Contractor. The Contractor shall see that they are properly located.
- D. Slots, chases, openings and recesses in the structure shall be cut by the Contractor.
- E. The Contractor shall patch and repair as required.

3.05 CLEANING

- A. All rubbish and debris resulting from the Work of this SECTION shall be collected, removed from the site and disposed of legally on daily basis.
- B. All floors shall be kept in a broom clean condition.
- C. After completion of the electrical installations the entire system shall be thoroughly cleaned to remove all foreign materials from the conduits, boxes and enclosure, equipment, lighting fixtures, light standards, panels, cords, etc.
- D. Cleaned shall mean the thorough removal of, but not limited to, dust, dirt, oil, grease, cement, plaster, welding spatters and paint spatters.
- E. All cleaning agents and methods shall be in accordance with the electrical equipment manufacturers' recommendations and subject to approval of the Authority.

3.06 ALTERATION AND DEMOLITION

- A. A complete and accurate description of all electrical work within the affected areas cannot be accomplished through the media of Drawings and Specifications. Where existing electrical work prevents proper construction of new materials, the Contractor shall remove, reroute, relocate, or in other ways alter the existing work in order to accommodate the new work requirements. Such performance shall be as generally outlined herein and found necessary under field conditions and shall be considered as included under the Contract.
- B. The Drawings are generally instructive of the alterations which involve the existing electrical work. It is not intended that such alterations be limited to these instructions.
- C. Where existing electrical equipment must be removed as a result of the alterations, it shall be completely demolished, back to the first outlet or junction box which is left unaffected by this work. All conduit, wire, supports, hangers, etc. shall be included under this requirement. Conduit which is encased in concrete or otherwise unaccessibly

positioned may be abandoned. In such cases wire shall be pulled out of conduit and the conduit itself shall be plugged and capped at each end.

- D. Existing electrical material and equipment, including lighting fixtures, switches, receptacles, conduit outlets, fittings, and other devices which are removed as a result of the alterations shall remain the property of the Authority and shall be stored on the site as directed.
- E. Existing electrical material and equipment with the exception of wire and cable, as generally outlined in the previous paragraph, shall be re-used as completely as is found practical. The Contractor shall examine the condition of such material and equipment and make a prior determination of whether it is suitable for re-use. The Contractor shall present findings periodically to the Engineer who in turn will make the final decision regarding re-usability. Wire and cable shall be new.
- F. Various signal, communications, and other services shall remain in service to provide continuous operation for the Authority's functions. No interruptions of any services will be allowed without written approval from the Authority.
- G. The Contractor shall remove or reroute electrical feeders, risers, branch circuits, and other wiring as required by the alterations or as shown on the Drawings. Wiring extending through remodeled areas but serving loads which must remain shall be rerouted as required, and reconnected to those loads.

END OF SECTION 26 10 00

SECTION 26 12 30
WIRES CABLES, SPLICES, TERMINATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section specifies all wires, cables, splices and terminations as well as appurtenances thereto required under this Contract.

- B. Related work specified elsewhere:

1.	Section 26 01 00	General Provisions
2.	Section 26 03 00	Electrical Demolition.
3.	Section 26 05 00	Raceways and Boxes.
4.	Section 26 10 00	Basic Electrical Materials and Methods
5.	Section 26 14 10	Wiring Devices.
6.	Section 26 17 00	Local Control
7.	Section 26 17 50	Local Control Panels
8.	Section 26 19 00	Grounding
9.	Section 26 19 50	Identification
10.	Section 26 33 53	Uninterruptible Power Supply
11.	Section 26 47 00	Panelboards
12.	Section 26 50 10	Lighting Fixtures
13.	Section 26 95 00	Electrical Testing

PART 2 PRODUCTS

2.01 GENERAL

- A. The Drawings show the locations, type, size and number of wires and cables to be furnished under this Contract. Each type shall comply with the Specifications contained herein.
- B. Only new cables shall be provided. Cables which have been manufactured more than two years prior to installation will not be accepted.
- C. The conductors, unless otherwise noted, shall be soft or annealed copper conforming to ANSI/ASTM B 33 if coated, ANSI/ASTM B 3 if uncoated. In addition, unless otherwise specified, stranded conductors shall have concentric stranding as per ANSI/ASTM B 8.
- D. Cables shall be supplied with both ends of each length sealed against the entry of moisture.

2.02 QUALITY ASSURANCE - AC CABLE

- A. All wires and cables shall be listed by Underwriter's Laboratories, Inc. and shall be copper.
- B. All wire and cable shall be stamped every two feet indicating, voltage, type, temperature rating, manufacturers name, etc., all in conformance with latest applicable standard.

- C. All conductors for wire and cable shall be copper based on 98 percent conductivity according to Mattheisen's Standard.
- D. All cables shall be compliant with the smoke and flame propagation requirements of NFPA 130 latest edition.

2.03 MATERIALS - AC WIRE AND CABLE

- A. Wire number 10 AWG and smaller shall be solid, wire number 8 AWG and larger shall be stranded. Control wiring shall be stranded in all sizes and color coded, as approved by the Authority.
- B. All wire Number 6 AWG and smaller, shall have color coded insulation. All wires Number 4 AWG and larger in each, pullbox, outlet, cabinet and every point where wires are accessible or visible, shall be color coded. The same color coding shall be used throughout the entire electrical system.
- C. Color as selected for the purpose of identifying circuits shall be applied to the wire. The colors shall be fast, fadeless and capable of withstanding cleaning in the event that the wire becomes soiled.
 - 1. Green shall be used only for ground wire.
 - 2. All conductors shall be color coded as follows:

	<u>240V/208V/120V AC</u>	<u>480/277V AC</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White
Ground	Green	Green

- D. All numerical references to wire size in the Specifications and on the Drawings refer to standard American Wire Gauge (AWG), or where so stated, thousands of circular mils (KCMIL).
- E. The Contractor shall submit for approval, before purchase of wire or cable, the following for each type and size to be furnished:
 - 1. Manufacturer of wire, cable.
 - 2. Number and size of strands composing each conductor.
 - 3. Conductor insulation, in 64ths of an inch.
 - 4. Sheath thickness in 64ths of an inch.
 - 5. Average overall diameter of finished cable.
 - 6. Minimum insulation resistance in megohms per 1,000 feet.
 - 7. Representative sample length including all labeling and identification.
- F. The Contractor shall provide wire with thermoplastic insulation type "THWN/AWM." Wire insulation shall consist of a tough, elastic, flexible rubber-like synthetic insulation compound made from 105 degrees C polyvinyl chloride or, its copolymer with vinyl acetate, covered with a nylon jacket. It shall be highly resistant to oil and moisture and shall not be affected by acid or alkali conditions, and marked by UL label as "Gas and Oil Resistant II."

- G. The insulation compound shall be suitable for operating without undue injury or deterioration; under conductor temperatures not exceeding 75 degrees C wet or dry, and 75 degrees C in oil UL rating; and shall be rated 600 volts.
- H. The thermoplastic insulation and nylon jacket shall be applied to the conductor in a manner that will provide continuous walls of uniform thickness, free from defects and of high dielectric strength.
- I. Type "THWN/AWM" insulated wire and cable shall be manufactured and tested in accordance with the requirements of UL and the latest ASTM Specifications for insulated wire and cable, polyvinyl insulation compound and nylon jacket, and shall also comply with IPCEA Standard S-19-81.
- J. All cable shall comply with FT/IEEE 1202 exposure requirements for cable char height, total smoke released, and peak smoke release rate and ANSI/UL 1685.
- K. In addition to requirements above, cables for circuits from ETS and UPS lighting, communications and fare control panels shall be fire rated for one hour in accordance with ANSI/UL 2196.

2.04 MATERIAL - AERIAL AND UNDERGROUND CABLE, AC SERVICE

- A. Aerial and underground cable shall be single conductor copper. Conductor insulation shall be XLP insulation/jacket, 600V type RHH-RHW-USE. All conductors shall have an overall jacket, resistant to ozone, sunlight and weather.
- B. Cable shall be rated, for continuous full-load operation, 90 degrees C in dry locations or 75 degrees C in wet or dry locations.

2.05 MANUFACTURERS

- A. AC Wire and cables shall be as manufactured by Pirelli, Okonite, Triangle Wire & Cable, or Rome, Product of Cyprus Wire, or Carol Cable - Division of Avnet, or approved equal.

2.06 CABLE SPLICING, TERMINATING AND ARC PROOFING MATERIALS

A. TERMINATIONS - AC WIRES AND CABLES:

1. Special care shall be taken to balance the loads on all phases, at all cabinets. The panelboard schedules show the proper circuiting, the Contractor shall not change this circuiting with out the approval of the Engineer. Distinguishing colors shall be used for identifying the particular phase on which the circuit belongs.
2. 600 volt cable lugs for terminations to busbar, switch studs, and terminal blocks, for Number 22 AWG to 10 AWG wire shall be color coded nylon insulated ring tongue lugs in vibration areas, and spade type in other areas. They shall have a secondary metal sleeve around the wire barrel for insulation strain relief. Type shall be Panduit Pan-Term PN series terminals.
3. 600 volt cable lugs for termination to busbar and switch studs for Number 8 AWG to 1/0 AWG wire shall be with standard barrel one hole high conductivity seamless copper lugs with inspection holes to assure adequate wire insertion. The tongue shall be stamped with wire size, UL & CSA logos and manufacturer. The base part number and stud size should also be stamped on the tongue to assure adequate identification in application. Barrels shall contain color coded rings, die color code and/or number. Crimp locations shall be indicated to assure correct installation. For further identification, the manufacturer should also be included on the barrel. Type shall be Panduit Series LCB or LCC Power Connectors or Burndy Type YA, or approved equal.

4. 600 volt cable lugs for termination to busbar and switch studs for number 2/0 AWG and larger wire shall be terminated with long barrel, two hole high conductivity seamless copper lugs. Barrels shall contain color coded rings knurled markings indicating die color code, die index numbers, and crimp locations to assure correct usage and installation. For further identification, the manufacturer should also be included on the barrel. For Number 2/0 to 250 MCM sizes, the tongue may be stamped with wire size, UL & CSA logos and manufacturer. The base part number and stud size should also be stamped on the tongue to assure adequate identification in application. Type shall be Panduit LCC series Power Connectors or Burndy Type YA, or approved equal.

B. SPLICES - AC WIRES AND CABLES:

1. Number 10 AWG and smaller wire shall be spliced with insulated butt connectors. Connectors shall contain a center wire stop for adequate wire insertion, translucent nylon insulated housings to insure accurate crimp location, and brazed seam construction for high performance terminations. Type shall be Panduit BSN Pan-Term Butt Splices or 3M "Scotch Lock."
2. Number 8 AWG and larger wire shall be standard barrel, high conductivity seamless copper splices. Barrels shall contain color coded rings knurled markings indicating die color code, die index numbers, and crimp location to assure correct usage and installation. For further identification, the base number and manufacturer should also be included on the barrel. Type shall be Panduit SCS series Power Connectors or 3M "Scotch Lock."
3. Number 10 AWG and smaller wire taps for solid wires shall utilize insulated compression type twist wing or nut style connectors with 105 degrees C, 600 volt rating, for UL listed wire combinations. Connectors shall have a tough nylon housing with a deep skirt to prevent shorts and flashovers, funnel entry to facilitate wire insertion, expanding square wire spring design to ensure reusability, as well as markings to indicate part number UL & CSA logos, and wire range. Nut Style connectors shall be of industry nut style color coding; Blue, Orange, Yellow, and Red (small to large) with comfortable ribs for greater gripping. Industry standard Wing Style color coding shall also be used; Yellow, Red, Blue (small to large), with offset wings to ensure comfort and torquing capability. In addition, black connectors may be used for temperature applications to 150 degrees C and green connectors for grounding applications. Type shall be Panduit "P-Conn" Wire Connectors or 3M "Scotch Lock."
4. Number 10 AWG stranded and smaller, taps shall be made with insulated compression type wire joints. Type shall be Panduit Type JN or approved equal.
5. Number 8 AWG and larger wire taps for stranded wire shall utilize compression taps up through 4/0 AWG wire or parallel gutter taps for larger wire. Taps shall have part number and wire range indicated on the body of the connector. Type shall be Panduit C-Tap Power Connectors or OZ Electrical Type XTP parallel gutter taps.

PART 3 EXECUTION

3.01 INSTALLATION - AC WIRES AND CABLES

- A. Wires and cables shall be carefully handled during installation. Joints and splices shall be made in an approved manner, and shall be equivalent electrically and mechanically to the conductor itself.
- B. Conduit fill shall be based on Chicago Electric Code for "New Work."

- C. All branch circuit and control wiring, in conduit shall be not less than Number 12 AWG wire unless noted otherwise.
- D. Stranded control cables in Number 12 AWG size and smaller shall be terminated into solderless lugs, then lug shall be connected to terminal part.
- E. At least six inch loops or ends shall be left at each outlet for the installation of fixtures or devices.
- F. All wires in outlet boxes not for the connection to fixtures, devices or other wires at that outlet, shall be rolled up and the ends capped or taped.
- G. All circuits in panelboards shall be neatly grouped and tied with seine twine, or nylon wire ties.
- H. No splice or any kind shall be pulled into any raceway. All splices and taps shall be accomplished in a manhole, handhole, junction, pullbox or other accessible enclosure.
- I. Wire and cable shall be delivered to the site in marked manufactures cartons.

3.02 WIRE PULLING LUBRICANT

- A. When necessary to use a lubricant for pulling wires in steel conduit, lubricant shall be UL listed and be of such consistency that it will leave no obstruction or tackiness that will prevent pulling out old wires or pulling in new or additional wires. No soap flakes or vegetable soaps shall be permitted.

3.03 TESTING

- A. Wires and Cables:
 - 1. After wires and cables are in place and connected to devices and equipment, the system shall be tested for shorts and grounds as specified in Section 26 95 00, Electrical Testing.
 - 2. All hot wires, if shorted or grounded, shall be completely removed and replaced in kind.
 - 3. A voltage test shall be made at the last outlet on each circuit. If the drop in potential is greater than permitted by the CEC, the Contractor shall correct the condition by removing and replacing partly grounded connections or reconnecting high resistance splice.
 - 4. All grounds, shorts and high resistance splices shall be remedied immediately at the conclusion of testing for acceptance.
 - 5. Any wiring device, or electrical apparatus provided under this Contract, if grounded or shorted shall be removed, trouble corrected and reinstalled.
 - 6. All high voltage cables, after in place and connected, shall be megged, in presence of the Authority.
 - 7. All meters, cable connections, equipment or apparatus necessary for making all tests shall be furnished by the Contractor at Contractor's own expense. The Contractor shall provide copy of all tests for Authority's approval of result.
 - 8. No work shall be covered up without approval of the Authority.

3.04 IDENTIFICATION OF WIRES AND CABLES

- A. General:
 - 1. All wires and cables, shall be identified by circuits in all cabinets, boxes, manholes, hand-holes, wiring troughs and other enclosures, at all terminal points.

2. The circuit designations shall be as shown on the Drawings, or as directed by the Authority. Tags shall be attached to wires and cables so that they will be readily visible.
- B. Cable/wire markers shall be installed on both ends of all conductors, both for internal and external cables. Cable/wire markers shall be as specified under Section 26 19 50 Identification.

END OF SECTION 26 12 30

SECTION 26 14 10
WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section specifies requirements for the furnishing and installing of wiring devices.
- B. The Contractor shall furnish, install and connect all wiring devices and plates as shown on the Contract Drawings and as hereinafter specified.
- C. All devices shall be heavy duty specification grade conforming to the latest NEMA configurations.
- D. In general all devices shall be one gang wide or wider as required for heavier rated devices.
- E. All devices for wall system outlets shall be supplied by one manufacturer. All furnished device plates shall be supplied by one manufacturer.
- F. All receptacle descriptions given herein are general in nature.
- G. Related work specified, elsewhere includes:
- | | | |
|-----|------------------|--|
| 1. | Section 26 01 00 | General Provisions |
| 2. | Section 26 03 00 | Electrical Demolition. |
| 3. | Section 26 05 00 | Raceways and Boxes. |
| 4. | Section 26 10 00 | Basic Electrical Materials and Methods |
| 5. | Section 26 12 30 | Wires, Cables, Splices, Terminations. |
| 6. | Section 26 17 00 | Local Control |
| 7. | Section 26 17 50 | Local Control Panels |
| 8. | Section 26 19 00 | Grounding |
| 9. | Section 26 19 50 | Identification |
| 10. | Section 26 47 00 | Panelboards |
| 11. | Section 26 50 10 | Lighting Fixtures |
| 12. | Section 26 95 00 | Electrical Testing |

1.03 QUALITY ASSURANCE

- A. The Contractor shall provide devices of the Specifications grade as minimum. Devices shall be of NEMA configuration and shall bear the label of the Underwriters Laboratories.

PART 2 PRODUCTS

2.01 LIGHTING SWITCHES AND TOGGLE SWITCHES

- A. Switches to be UL listed to Federal Specification WS896.
- B. Switches to be mounted at man-doors where shown on the Drawings, in suitable outlet boxes in the wall or partitions except where noted on the Drawings.

- C. Switches to be rated 20 amperes, 120/277 volts ac., surface mounted, and premium specification grade. The handle of each switch to be in color as required by the Authority.
- D. Wall switches to be two pole where indicated on drawings for heater and ventilation control.
- E. The switch color to be brown or ivory as approved by the Authority.
- F. Acceptable manufacturers for Single pole switches:
 - 1. Hubbell Catalog Number CSB 120
 - 2. Pass & Seymour Catalog Number 20 AC 1
 - 3. Leviton Catalog Number 1221-2 or equal
- G. Acceptable manufacturers for Two pole switches:
 - 1. Hubbell Catalog Number CS1222
 - 2. Pass & Seymour Catalog Number 20 AC 2
 - 3. Leviton Catalog Number 1222-2 or equal
- H. Acceptable manufacturers for Three way switches:
 - 1. Hubbell Catalog Number CS1223
 - 2. Pass & Seymour Catalog Number 20 AC 3
 - 3. Leviton Catalog Number 1223-2 or equal
- I. Acceptable manufacturers for Four way switches:
 - 1. Hubbell Catalog Number 1224
 - 2. Pass & Seymour Catalog Number 20 AC 3
 - 3. Leviton Catalog Number 1224-2 or equal.

2.02 CONVENIENCE OUTLETS

- A. Receptacles to be duplex, premium specification grade, rated 20 Amperes, 125 Volts, 3-wire grounding type, NEMA designation 5-20R. All receptacles to be enclosed in high heat, non-flammable, non-hydroscopic molded compound case. Each terminal to be provided with binding screws located on the side of the receptacle and so arranged that back or side wiring is possible.
- B. Receptacles to be UL listed to Federal Specification WC596. All outlets to be UL listed for wet locations.
- C. Provide green terminal screw for grounding.
- D. Receptacles exposed to the public to be of tamper resistant type. The presence of a metallic object in either the left or right slot to not energize the object. The presence of the plug blades in both the right and left hand slots is required to energize the load. The receptacle to not have any exposed current carrying parts but to have six inch pigtail leads for feed connection.
- E. Color of the outlets to be as approved by the Authority.
- F. Convenience outlets for general use: duplex, 3 wire, 20 Ampere, 125 volt, NEMA 5 20 R grounding type.

- G. Acceptable manufacturers for Convenience outlets:
 - 1. Pass & Seymour Catalog Number 5362.
 - 2. Hubbell Catalog Number 5362.
 - 3. Leviton Catalog Number 5362 or equal.
- H. Acceptable manufacturers for Clock outlet:
 - 1. Hubbell Number Catalog Number 5235.
 - 2. Pass & Seymour.
 - 3. Leviton Catalog Number 5261-CH.
- I. Ground fault circuit interrupters to be heavy duty, feed through, duplex type rated 20 Ampere, 125 volt, incorporating solid state ground fault sensing and signaling, 5 mA trip level. Outlets to be in color as required by the Authority with matching cover plate.
- J. Acceptable manufacturers for Ground fault circuit interrupters:
 - 1. Hubbell Catalog Number GF 5352
 - 2. Leviton Catalog Number 6899.
 - 3. Pass & Seymour Catalog Number 2091 S, or equal.
- K. Other outlets to be as called for on the Drawings and as specified herein.
- L. Receptacles exposed to the public to have weather proof vandal proof lockable covers. Covers to be as manufactured by Hubbell or equal. Provide actual sample of the cover to the Authority for approval prior to ordering.

2.03 SWITCH AND RECEPTACLE WALL PLATES

- A. Plates to be manufactured by the device manufacturer.
- B. Provide suitable plate for each device installed under this contract.
- C. In finished areas, plates to be metal, smooth high abuse; color to match hardware in surrounding area, as approved by the Authority.
- D. In unfinished areas, plates to be of the type designed for use with the particular boxes.
- E. In toilets, and utility rooms, plates to be Type 302/304 nonmagnetic stainless steel.
- F. Jumbo plates to be used on concrete block walls.
- G. Weatherproof, gasketed, vandal proof lockable spring type covers to be provided for weatherproof receptacles.
- H. Plates to be 0.040 inch thick, type 302/304, stainless steel unless otherwise noted.
- I. Surface mounted plates to be cast metal.
- J. All plates in public areas to be weatherproof, 8 inch by 8 inch.
- K. Acceptable manufacturers:
 - 1. Hubbell Catalog Number 5206
 - 2. Pass & Seymour Catalog Number PS 4510
 - 3. Leviton Catalog Number 4970 or equal

2.04 SURGE PROTECTIVE RECEPTACLES

- A. The Contractor shall provide one surge protective receptacle at each computer terminal, in addition to the computer data terminal shown on the Drawings. The color shall be as required.
- B. Each receptacle shall comply with UL 1449 and ANSI/IEEE C 62.41, latest edition.
- C. Each receptacle shall be Hubbell Number 5350 S, Leviton Catalog Number 5380 P, Pass & Seymour Catalog Number 6362 SP, or approved equal.

2.05 SURGE SUPPRESSION RECEPTACLES WITH ISOLATED GROUND

- A. The Contractor shall provide duplex surge suppression receptacles with isolated ground as shown on the Drawings. Each receptacle shall be provided with a power-on indicator light and audible alarm. The audible alarm shall energize when the surge protection is no longer functioning, and shall keep alarming until the module is replaced.
- B. Each surge suppression receptacle shall be UL listed to standards 1449 and 498 and CSA certified, (NEMA 5-15 R configuration only) and shall comply with ANSI/IEEE C 62.41, latest edition.
- C. The rating shall be shown on the drawings. The color shall be as required.
- D. The receptacles shall be manufactured by Eagle Catalog Number IG 1210, Hubbell Catalog Number IG-5252-S and Catalog Number SM-D 125, color as required, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Wall switches and receptacles to be located where indicated on the Drawings, arranged singly or in gangs and at the height specified or indicated and to have approved plates and finishes as specified herein.
- B. The Contractor to install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
- C. The Contractor to adjust the location of equipment to accommodate the work in accordance with field conditions encountered.
- D. Provide rust-resistant mounting hardware for all wiring device boxes.
- E. Receptacles on single outlet branch circuits to be the same rating as the branch circuit overcurrent protection.
- F. The Contractor to install wall switches with OFF position down.
- G. The Contractor to derate wall dimmers as instructed by the equipment manufacturer. The use of common neutral is not acceptable.
- H. The Contractor to install each convenience receptacle with the grounding pole on bottom when mounted vertically or on the right when mounted horizontally.

- I. The Contractor to install plates on all switch, and receptacle outlets and to install blank plates on all unused boxes.
- J. The Contractor to install devices and plates flush and level.
- K. The Contractor to seal all connections on GFCI with seal coat compound and wrap with two layers tape.
- L. Each switch to be mounted 4 feet 0 inches above the finished floor. Each receptacle to be installed at 1 foot 6 inches above finished floor, or unless shown otherwise on the Drawings.
- M. Each receptacle and switch to be side wired. Back wiring is not acceptable.
- N. Receptacles installed in areas accessible to the public to be equipped with lockable covers.
- O. Carefully install and connect switches, receptacles, and related accessory materials in such a manner as to complete the electrical installation in accordance with the Contract Drawings and as specified herein.
- P. Verify that electrical installation, structural, and related work by others to satisfy the requirements for the performance of the Work in accordance with the Contract Drawings and as specified herein.
- Q. In areas where exposed conduit is used, receptacles and switches must be surface mounted in a galvanized steel outlet box or conduit fitting and provided with a cast cover.
- R. Receptacles and switches located in finished areas where concealed conduit is used must be flush mounted and provided with a cover plate as specified in contract document.
- S. Location of each switch and receptacle in public spaces must be coordinated with architectural finishes. An 8 inch by 8 inch stainless steel cover plate must be provided for each device and must be vertically and horizontally centered within wall tile

3.02 PERFORMANCE TESTING

- A. The Contractor shall test the complete wiring device installations to assure proper operation.
- B. The Contractor shall test each ground fault interrupter to demonstrate each circuit trips between 2 to 5 milliamperes.

END OF SECTION 26 14 10

SECTION 26 17 00
LOCAL CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for the furnishing and installing of local control for this project.

- B. The Contractor shall furnish and install the disconnect switches, circuit breakers, fuses, motor starters, and control devices for local control as shown on the Drawings.

- C. Related work specified elsewhere:

1.	Section 26 01 00	General Provisions
2.	Section 26 03 00	Electrical Demolition.
3.	Section 26 05 00	Raceways and Boxes.
4.	Section 26 10 00	Basic Electrical Materials and Methods
5.	Section 26 12 30	Wires, Cables, Splices, Terminations.
6.	Section 26 14 10	Wiring Devices.
7.	Section 26 17 50	Local Control Panels
8.	Section 26 19 00	Grounding
9.	Section 26 19 50	Identification
10.	Section 26 33 53	Uninterruptible Power Supply
11.	Section 26 47 00	Panelboards
12.	Section 26 50 10	Lighting Fixtures
13.	Section 26 95 00	Electrical Testing

PART 2 PRODUCTS

2.01 MATERIALS

- A. The Contractor shall provide the required disconnect switches, circuit breakers, fuses, motor starters, and control devices as shown on the Drawings and as required in other Sections of these Specifications.

- B. All enclosures for the local control equipment shall be NEMA 12 for indoor locations and NEMA 4X stainless steel for outdoor locations and subway tube areas.

- C. Specific site requirements may necessitate the use of different enclosure ratings or manufacturing techniques.

2.02 SAFETY SWITCHES

- A. Safety switches shall be, heavy duty type, rated at 600 volts for 480 volts AC and 250 volts AC for 208 volts AC and 120 volts AC circuits.

- B. Each safety switch shall be heavy duty, horsepower rated, fusible or non-fusible as required.

- C. Each safety switch shall have an external handle that can be padlockable in the "OFF" position. The handle operation shall be non-teasible, quick make-quick break.
- D. Safety switches shall be provided with copper lugs and ground lugs. In addition, fusible switches shall be provided with rejection style fuse clips.
- E. Noncorrosive nameplates shall be laminated plastic with 3/8 inch black letters on a white background and shall be mechanically affixed to the front of each door with self tapping stainless steel screws. This shall not change the NEMA rating of the enclosure.
- F. Acceptable disconnect switch manufacturers shall be Siemens/ITE, Cutler-Hammer, Square "D" or approved equal.

2.03 FUSES

- A. The Contractor shall furnish and install fuses for all fusible equipment provided on this Project regardless of which trade has provided such equipment. All fuses shall be provided in accordance with the indications of size and voltage ratings given on the Drawings and shall have UL and NEC approval as being suitable protection for conductors under overload conditions.
 - 1. All fuses shall be of the same manufacturer.
 - 2. No paralleling of fuses will be permitted.
- B. Fuses shall be Bussmann Fusetron, Dual Element time delay fuses or approved equal; shall be Underwriters' Laboratories listed Class "RK-5" fuses having an interrupting rating of 200,000 amperes.
- C. Fuses shall be dual-element with a separate thermal element that will open at 280 degrees F or less; and shall have time-delay such that they will hold 500 percent rated current for a minimum of ten seconds in all sizes.
- D. The Contractor shall check each motor nameplate data and provide proper fuses for motor running protection.
- E. Spare fuses shall be furnished in the ratio of ten percent of each size and type installed, but not less than three of each size and type. All fuses blown during construction shall be replaced by the Contractor, and a complete supply of spare fuses shall be turned over to the Authority upon completion of the Project.
- F. Fuses shall be manufactured by Bussmann, Little Fuse or Mersen or approved equal.

2.04 CONTROL DEVICES

- A. Pushbutton stations, selector switches, etc. shall be 30mm heavy duty oil tight type and UL approved and the enclosures shall be NEMA rated for the area in which they are installed.
- B. Acceptable manufacturers shall be Siemens/ITE, Cutler-Hammer, Allen Bradley, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor shall install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
- B. The Contractor shall adjust the location of equipment to accommodate the work in accordance with field conditions encountered.
- C. The equipment shall be installed with work space clearances required by the Code.
- D. The equipment shall be installed to permit maintenance and replacement of parts, and shall be clear of all openings with swinging or moving doors, partitions or access panels.
- E. Safety switches and circuit breakers shall be installed 5 feet, 0 inches above finished floor unless shown otherwise on the Drawings.
- F. The Contractor shall provide a non-fused disconnect switch in accordance with the City of Chicago Electrical Code for each motor.

3.02 PERFORMANCE TESTING

- A. The Contractor shall test the complete local control installations to assure proper operation and correct sizing of all motor overload units and/or fuses.

END OF SECTION 26 17 00

SECTION 26 17 50
LOCAL CONTROL PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section specifies requirements for the furnishing and installing of local control panels.
- B. The work under this section includes furnishing all labor, materials, tools, equipment and incidentals necessary to install the local control panels.
- C. The Contractor shall furnish and install the local control panels as required by other Sections of these Specifications and as shown on the Drawings.
- D. Related work specified elsewhere:

- | | | |
|-----|------------------|--|
| 1. | Section 26 01 00 | General Provisions |
| 2. | Section 26 03 00 | Electrical Demolition. |
| 3. | Section 26 05 00 | Raceways and Boxes. |
| 4. | Section 26 10 00 | Basic Electrical Materials and Methods |
| 5. | Section 26 12 30 | Wires, Cables, Splices, Terminations. |
| 6. | Section 26 14 10 | Wiring Devices. |
| 7. | Section 26 17 00 | Local Control |
| 8. | Section 26 19 00 | Grounding |
| 9. | Section 26 19 50 | Identification |
| 10. | Section 26 33 53 | Uninterruptible Power Supply |
| 11. | Section 26 47 00 | Panelboards |
| 12. | Section 26 50 10 | Lighting Fixtures |
| 13. | Section 26 95 00 | Electrical Testing |

1.03 SUBMITTALS

- A. The Contractor shall prepare and submit to the Authority, for review, before fabrication and assembly of equipment, one electronic copy of CD ROM and one electronic PDF copy of each of the following:
1. Front and interior elevations shall be provided as required to show all equipment for each control panel.
 2. Drawings and section views shall include all dimensions for rough in work at the site.
 3. The shop drawings shall show the details of connections, terminals, etc. including the complete terminal block arrangement and enclosure ground connections.
 4. Single line diagrams where required to show equipment power distribution and control schematic diagrams shall be provided.
 5. Wiring Diagrams:
 - a. Connection diagrams for the wiring of equipment in each local control panel shall be provided.
 - b. Interconnection diagrams shall show the wiring to external equipment. The terminal block points shall be clearly identified for the external wiring to be routed in or out of each local control. The wiring diagrams shall

provide adequate space at the terminal blocks for the addition of cable and wire designations.

6. Bills of material shall include all items with catalog cuts describing the electrical and physical characteristics of each item.
- B. The Contractor shall submit, for record and distribution, prior to shipment of equipment, electronic copy on CD ROM and five PDF electronic copies of each of the following for each local control panel.
1. All drawings shall be as finally reviewed and shall include any factory assembly modifications.
 2. Recommended installation and storage instructions with any special instructions shall be provided.
- C. The Contractor shall submit, for record and distribution, prior to shipment of equipment, one electronic copy on CD ROM and five PDF electronic copies, and ten hard copies of each of the following for each local control panel assembly.
1. Instruction manuals shall include descriptive bulletins and operation leaflets for the control relays, switches, starters, and circuit breakers.
 - a. Each instruction manual shall be in a three ring hard binder with tabbed sections. The binder cover shall have the project name and equipment name. The lettering shall be block type and shall be a minimum height of 1/2 inch.
 - b. Each instruction manual shall contain the "Record Document" drawings, complete operating and instruction manuals, spare parts lists, certified test documents, and other special data required for this equipment.
 - c. The "Record Document" drawings larger than 8 1/2 by 11 inch shall be fan folded.
 2. Spare parts bulletins shall be included with catalog cuts for each item.
 3. For large projects control panel instructions can be combined with other project material instructions.
 4. Certified test reports shall include all assembly and subassembly test and inspection reports.
- D. The Contractor shall submit one electronic copy in CD ROM and five PDF electronic copies and ten hard copies of any shop drawings and other data sheets that were revised or modified during installation. These will be inserted in the previously submitted instruction manuals.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Local control panels furnished by the supplier of the equipment, and or the Contractor may be supplied as commercially available "Enclosed Control" as manufactured by Eaton (Cutler-Hammer), Square D, Siemens or equal, factory modified and shall conform with the requirements specified herein.
- B. Each commercially produced local control panel shall be UL listed.
- C. Each specialty local control panel shall be UL and IBEW labeled.

- D. In general, all commercially produced local control panels installed indoors shall be NEMA 12 and NEMA 4X when installed in unheated, outdoors or in subway areas. Each specialty local control panel shall be fabricated as specified below.
- E. Specific site requirements may necessitate the use of different enclosure ratings or manufacturing techniques.
- F. Specialty enclosures shall be wall-mounted single-door, with back panels, similar to Hoffman Engineering Company Type A-12 or equal, as shown in the Contract Drawings, with the following additional requirements:
1. Enclosures for indoor locations shall be formed of 12-gauge galvaneal sheet steel minimum, seams continuously welded and ground smooth, without openings or knockouts, with external wall mounting brackets, and collar studs for mounting panel. Back panels shall be formed of 12 gauge galvaneal steel, a rolled lip shall be formed on all sides of the door opening. Size shall be as shown on the Drawings.
 2. Doors shall be formed of 12-gauge galvaneal sheet steel with rolled lip along top and sides to mate with the enclosure. The door shall be fitted with a print pocket and a closed-cell neoprene gasket attached with oil-resistant adhesive and bonding stud.
 3. Cabinet door shall be equipped with a concealed full length, stainless steel continuous piano type hinge. Yale Company, Division of Eaton Security Products & Systems, Catalog Number S 1400, or Corbin Cabinet Lock Company Catalog Number 1000 vault handles with disc tumbler locks and three point latch shall be provided on doors twenty-four inches or over in height. Yale Company, Division Eaton Security Product & Systems Catalog Number T 1403, or Corbin Cabinet Lock Company Catalog Number 1001 handles with disc tumbler locks and one point latch shall be provided on doors under twenty-four inches in height.
 4. Two keys shall be furnished with each cabinet and lock. All cabinet locks shall be provided to accept a CAT 60 Master Key (Corbin Lock or H. Hoffman Co.). Lock shall be arranged to permit key removal in locked and unlocked positions.
 5. For outdoor or subway locations, enclosure including door and back panel shall be stainless steel. The cabinet shall be Type 304 stainless steel. Handle will be provided as heavy duty padlockable stainless steel and three point latch suitable for outdoor or subway installations.
 6. Enclosures less than 24" can be constructed from 14 gauge galvaneal steel or 304 stainless steel as applicable.
 7. Specialty enclosures shall bear UL-508 industrial control labels with respective UL enclosure ratings based on location of the installation and construction of the enclosure.
- G. Each stainless steel enclosure located outdoors or in unheated areas, shall have thermostatically controlled space heaters. Enclosures located in subway areas shall also be supplied with breather drains when specified.

2.02 DISCONNECT SWITCHES AND CIRCUIT BREAKERS

- A. Disconnect switches shall be provided as horsepower rated, heavy duty type, fusible or non-fusible as indicated on the drawings. Non-fusible switches shall be rated at 600 volts for 480 volt and 240 volt service. Fusible switches shall be rated at 600 volt for 480 volt service and 250 volt for 240, 208 or 120 volt service. Fusible disconnects shall be provided with rejection fuse clips. Fuses and spares to be provided as specified. External operator to be provided. Disconnect switches shall be heavy duty type, rated at 600 volts for 480 volt AC circuits and 250 volts for 208 volt AC and 120 volt AC circuits. Each disconnect switch shall be horsepower rated.
- B. Circuit breakers, shall be rated at 600 volts for 480 volt AC circuits and 240 volts AC for 208 volts AC and 120 volts AC circuits.
- C. Circuit breakers shall be the heavy duty industrial type. Circuit breakers for 480 volt and 277 volt service shall have a minimum frame size of 100 amperes and shall be rated for 600 volts. The trip settings shall be as shown on the Drawings. The breaker interrupting rating shall be 65,000 amperes, symmetrical at 480 volts AC. External operator to be provided.
- D. Circuit breakers for 120 volt and 208 volt service shall be 240 volt rated. Industrial molded case style (miniature industrial breakers or panelboard style breakers are not acceptable) shall be of the "bolt on" type and shall have an interrupting rating of 65,000 amperes at 240 volts AC. The trip settings shall be as required or as shown on the Drawings. External operator to be provided.
- E. Circuit breakers provided for motor circuit protection shall be of the motor circuit protector type, sized to coordinate with the motor starter overloads and have an interrupting rating of 65,000 amps in combination with starter overloads. External operator to be provided.
- F. Disconnects and breakers to be provided with copper terminal lugs if available.
- G. Acceptable circuit breaker and disconnect switch manufacturers shall be Square D, Eaton (Cutler-Hammer), Siemens, or approved equal.

2.03 CONTACTORS AND STARTERS

- A. Contactors and starters shall be heavy duty type, NEMA style, rated 600 Volts AC, electrically held, minimum NEMA size 1 and with the number of poles shown on the Drawings. Contactors and starters to be supplied with 120 volt AC coils (unless otherwise noted) and one (1) normally open, one (1) normally closed spare auxiliary contacts over and above the auxiliary contacts required by the control circuit.
- B. Starters to be provided with solid state overload relays with external resets.
- C. Spare contact kits and operating coils to be provided in the ratio of ten percent of each size installed, but not less than one of each size to be turned over to the Authority upon completion of the project.
- D. Acceptable manufacturers for commercially available enclosed control shall be Square D, Eaton (Cutler-Hammer), Siemens or approved equal. Acceptable manufacturers for specialty enclosed control shall be Illinois Switchboard Corporation, Panatrol, Perigon Systems, Inc. or Gus Berthold Electric Company.

2.04 CONTROL DEVICES

- A. Pushbuttons, selector switches, indicating lights, etc. shall be heavy duty oil-tight type 35MM, corrosion resistant if required by the application and UL approved. Enclosures shall be NEMA rated for the area in which they are installed.
- B. Pilot lights shall be heavy duty, oil-tight, LED type with red (on) and green (off) lenses. A push to test circuit shall be provided when more than two lights are required.
- C. Acceptable manufacturers shall be Square D, Siemens, Eaton (Cutler-Hammer), or approved equal.

2.05 CONTROL CIRCUITS

- A. Control circuits for motors shall operate at 120 volt AC, unless otherwise shown on the drawings. Control circuits for single phase 120 volt motors shall be connected phase to neutral. Control circuits for 208, 240 or 480 volt motors shall be provided with a control power transformer within the enclosure with two (2) primary and one (1) secondary fuse unless otherwise shown on the drawings. One complete set of spare control fuses to be supplied mounted within the assembly. Control power transformers to be supplied with 50 VA extra capacity over and above the capacity shown for all devices powered by the control circuit.

2.06 CONTROL RELAYS

- A. Logic Level control relays to be 3 pole double throw, 120 volt AC, and octal style base with LED indicating light, test feature, matching socket with screw clamping terminals and hold down spring. Contacts shall be rated 1/3 H.P. @ 120 volt AC, pilot duty class B300. Relays to be Eaton Cutler-Hammer type D3PF or Square D type RPM.
- B. Power control relays or relays used in circuits requiring more than three contacts shall be industrial grade, 120 volt AC operated, multi-contact, load voltage and current rated. Relays shall be rated 600 volts AC and shall have convertible, double-break silver alloy contacts with pressure wire connectors. Contacts shall be provided with normally open or normally closed status indication, rated 600 volts 10 amps, class A600. Relays to be Eaton Cutler-Hammer type AR or D26, or Square D class 8501 type X.
- C. Spare relays to be provided in the ratio of ten percent of each type installed, but not less than one of each size to be mounted in the enclosure.

2.07 TIMING RELAYS

- A. Pneumatic timing relays shall be "Off Delay" or "On Delay" type with an adjustable timing range as specified on the drawings with, instantaneous contacts if required by the application. Timers shall be rated for 120 volt 60HZ. Operation unless otherwise noted. Pneumatic timing relays shall be agastat series 7000.
- B. Solid state timing relays shall have the function specified with a fixed or adjustable timing range, plug in octal style base, matching socket with screw clamping terminals and hold down spring. Solid state timers to be Square D Class 9050 Type JCK or approved equal.
- C. Spare solid state timers to be provided in the ratio of ten percent of each type installed, but not less than one of each size to be mounted in the enclosure.

2.08 TIME CLOCKS

- A. Time clocks to be electromechanical 24 hour, with skip a day feature, contact configuration as shown. Suitable for operation at 120 volt AC, 60 HZ. With mechanical spring reserve. Time clocks to be tork 7000 series or approved equal.

2.09 DOOR SWITCHES

- A. Provide security type magnetic door switches and associated wiring where shown on the Drawings.
- B. Door switches shall be of the concealed type, 3/4 inch diameter, with plated Rhodium contacts. Door switches shall be Simplex 27760-9000 series or approved equal.

2.10 NAMEPLATES

- A. A nameplate shall be provided on the exterior of each panel to describe the panel and equipment it serves.
- B. The name of the driven equipment shall appear on each starter and breaker.
- C. Non-corrosive nameplates shall be laminated plastic with 3/8 inch black letters on a white background and shall be mechanically affixed to the front of each door with self tapping stainless steel screws. This shall not change the NEMA rating of the enclosure.
- D. Component nameplates shall be installed to designate the purpose of all switches, breakers, instruments, relays, fuses, etc.

2.11 CABLE, TERMINATIONS, AND CABLE TAGGING

- A. Where possible, compression type cable lugs for terminating cables and equipment within the panel and entering and leaving the panel shall be furnished by the equipment manufacturer. Copper compression connectors shall be crimp, type, long barrel tin plated closed end compression. All connectors shall be copper. The barrel for each cable lug shall be sized for the exact cable size specified. Copper type connectors and terminations shall be furnished. Copper-Aluminum connectors are not acceptable. Connectors shall be Burndy Type YA, Panduit Series LCB or LCC, Anderson Type VHCL, T & B Series 54800 and 54900, or approved equal.
- B. Cable lugs for terminations to busbar, switch studs, terminal blocks, and other devices, for Number 22 AWG to 10 AWG wire shall be 600 Volt, color coded nylon insulated ring tongue lugs. They shall have a secondary metal sleeve around the wire barrel for insulation strain relief. Type shall be Panduit Pan-Term PN series terminals. Locking fork-type lugs can be used for connections to devices provided with captive fasteners.
- C. Cable lugs for terminations of Number 8 AWG to 1/0 AWG wire shall be standard barrel, one hole high conductivity seamless copper lugs, with inspection holes to assure adequate wire insertion. The tongue shall be stamped with wire size, UL & CSA logos and manufacturer. The base part number and stud size should also be stamped on the tongue to assure adequate identification in application. Barrels shall contain color coded rings, die color code and/or number. Crimp locations shall be indicated to assure correct installation. For further identification, the manufacturer should also be included on the barrel. Type shall be Panduit Series LCB or LCC Power Connectors or Burndy Type YA, or approved equal.
- D. Cable lugs for terminations of number 2/0 AWG and larger wire shall be long barrel, two hole high conductivity seamless copper lugs. Barrels shall contain color coded rings knurled markings indicating die color code, die index numbers, and crimp locations to assure correct usage and installation. For further identification, the manufacturer should also be included on the barrel. For Number 2/0 to 250 MCM sizes, the tongue may be stamped with wire size, UL & CSA logos and manufacturer. The base part number and stud size should also be stamped on the tongue to assure adequate identification in

application. Type shall be Panduit LCC series Power Connectors or Burndy Type YA, or approved equal.

- E. Cable/wire markers shall be installed on both ends of all conductors, both for internal and external cables. The cable/wire markers for external connections shall comply with Section 26 19 50 Identification. The cable/wire markers for internal wires and cables shall be self-adhesive, self-laminating mechanically printed with a clear protective laminating over wrap or mechanically printed with a clear protective laminating over wrap or sleeve type tubing mechanically printed with permanent non smearing ink. Sleeve type wire markers shall be properly sized for the conductor they are being installed on.

2.12 CONTROL DEVICES AND WIRING

- A. Control devices, local instrument cables, and wiring required on the equipment shall be furnished and installed at the factory.
- B. All small wiring for control or accessory equipment shall be installed in code approved wireways as necessary.
- C. Control panel internal wiring shall be Number 14 AWG, minimum, except for incidental wiring on mass produced pre-manufactured sub-assemblies or where larger size conductors are needed for current carrying requirements. The conductors shall be stranded copper for fixed wiring and extra flexible copper for hinged wiring. The conductors shall have 600 volts, 90 degrees C, polyvinyl chloride insulation with flameproof braid covering, Type TBS, or cross-linked polyethylene, Type SIS.
- D. All control and instrument wiring, alarm leads, and instrument transformer secondaries, for connection to external cables, shall be terminated at terminal blocks. Terminal blocks shall be UL/CSA recognized, 94V-2 thermoplastic material, snap on rail mounted design, 30 amp 600 volt, with marking strip, with #6-32 terminal screws for use with crimp on ring style wire connectors. Cooper Bussmann (USD) type NSS3-WH, Eaton Cutler-Hammer type TBAL30 or equal. 10% spare terminals to be provided. Terminal blocks for current transformer secondaries shall be shorting type Cooper Bussmann type KUSC or Marathon 1500SC series.
- E. Compression, type (solderless) copper lugs shall be furnished for each terminal block for external control and instrument wires. Minimum field wire size shall be AWG No. 12. Cable lugs for terminations to busbar, switch studs, terminal blocks, and other devices, for Number 22 AWG to 10 AWG wire shall be 600 Volt, color coded nylon insulated ring tongue lugs. They shall have a secondary metal sleeve around the wire barrel for insulation strain relief. Type shall be Panduit Pan-Term PN series terminals. Locking fork-type lugs can be used for connections to devices provided with captive fasteners.
- F. Cable/wire markers shall be installed on both ends of all conductors both for internal and external cables. Cable and wire markers shall comply with this specification section.
- G. Control cables shall be neatly routed and supported in cable duct within the cabinet.
- H. The assembled control equipment, wiring and connections shall be insulated for a voltage of 600 volts and shall be subjected to a one minute dielectric test AC phase to ground at the factory after fabrication and assembly is complete. Dielectric test value shall be twice the rated voltage of the lowest rated device plus 1000 volts.
- I. Spare fuses shall be provided mounted in the assembly.
- J. The specialty assembled control equipment shall be provided with UL 508 industrial control label with respective enclosure label or equal.

2.13 TESTING

- A. The assembled control equipment, wiring and connections shall be functionally tested for operation. Copies of test reports shall be provided with the documentation package.

2.14 PAINTING

- A. All interior and exterior seams shall be carefully filled and sanded smooth for neat appearance. The equipment manufacturer shall remove oils and dirt and form a chemically and anodically neutral conversion coating, to improve the finish-to-metal bond, and to provide resistance to rust. All surfaces shall be phosphatized before any of the protective coatings are applied. The final coat for non-stainless steel surfaces shall be semi-gloss enamel to provide adhesion, resiliency, durability, color stability, and stain resistance.
- B. The exterior surface of all non stainless steel structures shall be thoroughly cleaned and given a coat of primer and a finish coat of the equipment manufacturer's standard of ANSI Standard light gray enamel color Number 61 for outside surface.
- C. The interior surface of all non stainless steel surfaces shall be given a primary coat and a finish coat of ANSI Standard light gray enamel color Number 61.
- D. Sub pans shall be painted white.
- E. The equipment manufacturer shall provide an adequate supply of touch-up paint in aerosol cans.
- F. A packaged kit of refinishing materials, with complete instructions, shall be included with each shipment for touch-up in the field.

2.15 MANUFACTURERS

- A. Each local control panel shall be assembled and manufactured by Berthold Electric Company, Illinois Switchboard Corporation, Panatrol, Perigon Systems, Inc., Siemens/ITE, Cutler-Hammer Electric, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor shall install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
- B. The Contractor shall adjust the location of equipment to accommodate the work in accordance with field conditions encountered.
- C. The equipment shall be installed with work space clearances required by the Chicago Electrical Code.
- D. The equipment shall be installed to permit maintenance and replacement of parts, and shall be clear of all openings with swinging or moving doors, partitions or access panels.
- E. Mounting bases for floor mounted control panel:
 - 1. The Contractor shall install each floor mounted control panel on a 4 inch thick concrete housekeeping pad of sufficient size plus at least a 4 inch apron as specified in other specification sections within this division. Panels mounted in rooms with slabs on grade shall have a non-conductive fiberglass mat installed between the panel and the concrete pad. Anchor bolts or fasteners shall comply with the Authority's requirements for isolated connections.
 - 2. Each foundation shall be level, stable, and compacted to 95 percent Standard Proctor.
 - 3. Conduit locations shall be in accordance with equipment manufacturer's approved shop drawings.
- F. Wall Mounted Control Panel:
 - 1. Each wall mounted control panel shall be supported and mounted away from the wall with "C" shaped channel. The channel shall be fiberglass, when stray current control isolation is required, and hot dipped galvanized steel for normal applications. The minimum separation between the equipment and the wall shall be one inch.
 - 2. Each control panel shall be mounted with the top a maximum of 6 feet 6 inches above the finished floor.

3.02 PERFORMANCE TESTING

- A. The Contractor shall test each complete local control panel installation to assure proper operation and correct sizing of all control fuses and motor overload units.

END OF SECTION 26 17 50

SECTION 26 19 00
GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies grounding requirements for this project.
- B. The Contractor shall furnish and install complete a grounding system as required by the Drawings and as required by these Specifications.
- C. Related work specified, elsewhere:

1.	Section 26 01 00	General Provisions
2.	Section 26 03 00	Electrical Demolition.
3.	Section 26 05 00	Raceways and Boxes.
4.	Section 26 10 00	Basic Electrical Materials and Methods
5.	Section 26 12 30	Wires, Cables, Splices, Terminations.
6.	Section 26 14 10	Wiring Devices.
7.	Section 26 17 00	Local Control
8.	Section 26 17 50	Local Control Panels
9.	Section 26 19 50	Identification
10.	Section 26 33 53	Uninterruptible Power Supply
11.	Section 26 47 00	Panelboards
12.	Section 26 50 10	Lighting Fixtures
13.	Section 26 95 00	Electrical Testing

PART 2 PRODUCTS

2.01 MATERIALS

- A. Grounding conductors, other than bus bars, shall be stranded copper wire, with type XHHW green 600 volt, rated insulation sized and installed in accordance with Code requirements, and as noted on the Drawings.

2.02 GENERAL GROUNDING REQUIREMENTS

- A. The equipment ground conductor shall be distinct and separate from the system neutral ground conductor and shall not be used as a load current-carrying conductor. The equipment ground conductor shall be electrically and mechanically continuous from the transformer neutral ground to the equipment to be grounded. The equipment ground conductor shall provide a low impedance path for line-to-ground fault currents and bond all non-current carrying enclosures together including raceways, fixtures, receptacles, panels, controls, motors, disconnect switches, and exterior lighting standards.
- B. Where building type conductors are installed in a raceway, the equipment ground conductor shall have a minimum size conductor of Number 12 AWG copper. Where green insulation is not available, on large size cable, black insulation shall be used and shall be identified with green colored tape at each junction box or device enclosure.

- C. Wiring channels, cable trays, and all metallic conduit including rigid electrical metallic tubing and flexible conduits, shall be connected at each end to the equipment ground conductor utilizing a conduit grounding bushing, O-Z type BL, or approved equal.
- D. Switchboards, panelboards, motor control centers, and panels shall be provided with an equipment ground bus (including lug or screw terminals) and shall be securely bonded to the enclosure. Junction boxes and other enclosures (sizes above 5 inches by 5 inches) shall utilize an equipment ground bus or lug as required to securely bond the equipment ground conductor to the enclosure.
- E. Lighting fixtures shall be securely connected to the equipment ground conductor. A continuous row of fluorescent fixtures mechanically joined to provided good electrical contact may be considered as one fixture with the equipment ground conductor connected at only one point.
- F. Motors shall be connected to the equipment ground conductor. Bolts, nuts, and washers shall be bronze, cadmium plated steel, or other noncorrosive material.
- G. For elevated stations, the steel structure that supports the Rapid Transit ROW shall serve as the Code required reference grounding electrode. Provide exothermic connection, where service ground conductor is connected to track structure.

PART 3 EXECUTION

3.01 GROUNDING SYSTEM

- A. The intent is to set forth requirements for an effective ground system. The ground system shall be installed so that the line-to-ground circuit has an impedance sufficiently low to limit the potential above ground to a level that shall ensure freedom from dangerous electric shock-voltage exposure to the persons in the area, and to facilitate the operations of the overcurrent devices in the circuit.
- B. The entire power and lighting systems shall be permanently and effectively grounded in accordance with the latest issue of the Chicago Electrical Code. The items covered shall include but not be limited to panels, motor frames, lighting fixtures and associated switches and other exposed, non-current carrying parts of the electrical equipment and as shown on the Drawings.
- C. In general, the conduit systems shall contain a equipment ground wire.
 - 1. Continuity of ground shall be maintained throughout the conduit systems, in particular the PVC conduit, as required by the City of Chicago Electrical Code.
 - 2. Ground bushings and jumpers shall be used wherever the normal metallic conduit termination does not insure continuity of ground.
- D. Concealed or inaccessible grounding connections shall be made with exothermic process.
 - 1. Accessible grounding connections shall be bolted or clamp type unless otherwise indicated.
 - 2. Soldered connections will not be permitted in the grounding system.
- E. Grounding conductors shall be protected from mechanical damage, and shall be supported in an approved manner.

- F. Grounding connections made below grade shall include the installation of waterproof tape.
- G. Where ground conductors are run in conduit or other raceway, the ground conductor shall be bonded to the conduit or raceway at each end.

3.02 CONTINUOUS GROUND BUS

- A. Switchboards, panelboards, and motor control centers shall have a continuous ground bus within the enclosure, bonding all sections together.
- B. The ground bus shall be connected to the main service ground by means of a grounding conductor run in the same conduit or raceway as the feeder conductors.
- C. When indicated on the contract drawings, a continuous ground bus 1/4 inch by 2 inches shall be surface mounted 1 foot above floor level around the perimeter of the Electrical and Communications rooms. The ground bus in the Electrical room shall be connected to the track structure by an insulated Number 4/0 AWG ground conductor, the ground bus in the Communications room shall be connected to the ground bus in the Electrical room by a 4/0 AWG ground wire.

END OF SECTION 26 19 00

SECTION 26 19 50
IDENTIFICATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies equipment, wire and conduit identification

- B. Related work specified elsewhere:

- | | | |
|-----|------------------|--|
| 1. | Section 26 01 00 | General Provisions |
| 2. | Section 26 03 00 | Electrical Demolition. |
| 3. | Section 26 05 00 | Raceways and Boxes. |
| 4. | Section 26 10 00 | Basic Electrical Materials and Methods |
| 5. | Section 26 12 30 | Wires, Cables, Splices, Terminations. |
| 6. | Section 26 14 10 | Wiring Devices. |
| 7. | Section 26 17 00 | Local Control |
| 8. | Section 26 17 50 | Local Control Panels |
| 9. | Section 26 19 00 | Grounding |
| 10. | Section 26 33 53 | Uninterruptible Power Supply |
| 11. | Section 26 47 00 | Panelboards |
| 12. | Section 26 50 10 | Lighting Fixtures |
| 13. | Section 26 95 00 | Electrical Testing |

PART 2 PRODUCTS

2.01 EQUIPMENT IDENTIFICATION

- A. After finish painting is completed, the Contractor shall provide white with black core laminated phenolic nameplates with 3/8 inch lettering etched through the outer covering. Each nameplate shall be fastened with stainless steel screws to each piece of equipment, in a way that will not void the NEMA rating for the enclosure.

1. All major electrical equipment shall be identified which shall include motor starters, disconnect switches, panelboards, transfer switches, transformers etc.
2. Disconnect switches serving feeders and overcurrent protective devices mounted in a switchboard shall also be identified.

- B. Embossed self-adhering plastic tape labels will not be accepted.

2.02 WIRE IDENTIFICATION

- A. Cable/wire markers shall be installed on both ends of all conductors.

- B. All wire and feeder cables shall be labeled with wire markers in all junction boxes, pull boxes, control panels, motor control centers, panelboards, switchboards, etc.

- C. Wire and cable markers shall be self- adhesive, self- laminating mechanically printed with a clear protective laminating over wrap or mechanically printed with a clear protective laminating over wrap or mechanically printed heat shrink tubing. Cable and wire markers

shall be approved by the Engineer and shall be attached to all cables where entering or leaving the conduit run. The cable designation and circuit use shall appear on the tag.

- D. Acceptable manufacturers shall be Brady, Panduit, 3-M, Thomas and Betts, or approved equal.

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

- A. Each nameplate shall include the equipment designation as shown on the Drawings, as approved by the Engineer, and other information as required in the Specifications.
- B. The Contractor shall provide the following identification markings on each individually mounted circuit breaker, disconnect switch, contactor, and motor starter:
1. Feeder name, number, voltage and phase.
 2. Item of equipment controlled.
- C. The Contractor shall provide the following identification markings on each motor and other utilization equipment, except lighting fixtures:
1. Equipment tag designation.
 2. Feeder number
 3. Voltage and phase.
- D. The Contractor shall provide the following identification markings on each transformer:
1. Equipment tag designation.
 2. Feeder number
 3. Voltage and phase.
 4. Name of lighting and/or power panels supplied by the secondary of the transformer.
- E. The Contractor shall provide a typewritten directory of circuits in lighting and power panels and provide panel identification in black alkyd paint stenciled inscriptions on the inside of the door, directly above the centerline of directory frame, or on vertical and horizontal centerline of doors without directory frames.
- F. The Contractor shall provide on device plates for local toggle switches, toggle switch type manual starters, pilot lights, and other electrical items whose function is not readily apparent, engraved suitable inscriptions on laminated phenolic nameplates describing the equipment controlled or indicated.
- G. Each nameplate shall be fastened with a minimum of two self-tapping stainless steel screws. This shall not change the NEMA rating of the enclosure.
- H. The Contractor shall provide the following alkyd paint stenciled inscription markings on the outside face and on the inside face of each feeder splice box, feeder junction box, and feeder pull box cover plate:
1. Designation shown on the Drawings.
 2. Feeder name.
 3. Feeder number.
 4. Voltage and phase.

3.02 CONDUIT, WIRE, CABLE AND BUS IDENTIFICATION

- A. Each wire and each cable shall be labeled at terminals and at all accessible points in equipment, panelboards, manholes, handholes, and pull boxes. Labels shall be self-sticking wire markers.
- B. Each cable run shall be assigned a circuit number and shall be recorded on a cable schedule showing from, to, purpose, number of conductors and length.
- C. Cable/wire markers shall be the wrap-around self-adhesive type, with factory or mechanical printed numbers, letters and symbols which shall be used to identify all feeders, mains and branch circuit conductors.
- D. All conductors shall be tagged in cabinets at the time wires are pulled in and tested and markers shall not be removed for any reason.
- E. Phase identification letters, in readily visible locations, shall be stamped into the main bus bars of switchboards and panelboards.

3.03 ROOM IDENTIFICATION

- A. On each interior wall of each electrical room, the Contractor shall provide a vitreous enameled metal sign or plastic sign, red on white, reading "Electrical Equipment Room - No Storage Permitted". Letter font size shall be one inch. Signs shall be mounted at clearly visible locations within the rooms or on the inside of doors where wall space within the room is not available.
- B. Each sign shall be manufactured by Panduit, or approved equal.

END OF SECTION 26 19 50

SECTION 26 21 16
ELECTRICAL UTILITY SERVICE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this Section.

1.02 SUMMARY

- A. This Section specified the requirements for the accommodating ComEd service charges for this project and for contractor work related to electrical services.
- B. The Work under this Section to include all labor, materials, tools, equipment and incidentals necessary to provide complete new service entrance, including but not limited to conduit, cable, cable limiters, underground duct banks, grounding, fencing and foundations, penetration and sealing of come manholes/vaults/facilities.

PART 2 PRODUCTS

2.01 GENERAL

- A. Contractor to provide one new service (Normal Service) that is to be 208 volt, three-phase, three wire services, and 60 hertz. Services will be metered at 120/208 volt, three-phase, four wire.

2.02 SERVICE LOCATION

- A. Normal Service and Reliable Service will be provided from existing ComEd manhole located mid-block between Madison and Washington on Wabash as shown on Contract Drawings.
- B. Contractor to install new service and conduit and cable from service manhole to new service equipment, as shown on the Contract Drawings.
- C. Normal Service: Contractor to install a new conduit duct bank in location shown on the Contract Drawings. Contractor to provide sufficient cable slack for connections.
- D. Reliable Service: Not applicable.
- E. ComEd to provide and install equipment in manhole as required to new service drop locations.
- F. ComEd to be responsible for all permits to accomplish their work.
- G. Contractor to connect service cables at point of service in ComEd Manhole.
- H. All work to comply with the applicable requirements of ComEd.

2.03 METERING EQUIPMENT

- A. ComEd to furnish and install meters in Contractor supplied meter sockets located in the meter cabinet.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to provide all materials and labor as required by this Contract and by ComEd service contract agreement being provided by ComEd to complete the services to the facility.
- B. It to be the responsibility of the Contractor to contact the appropriate personnel within ComEd to determine the exact nature of the work involved. For information form ComEd, please contact Mr. Rahath Ahmed, phone # 773-509-3746.
- C. The Contractor to coordinate all work with ComEd. All work to be installed in accordance with ComEd Standards and Requirements.
- D. All work to be installed in accordance with the Chicago Electrical Code, and CTA requirements.
- E. The Contractor to coordinate work of other Sections and with ComEd as required

END OF SECTION 26 21 16

SECTION 26 25 10
AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies the furnishing and installing of automatic transfer switches.
- B. The Contractor shall furnish and install complete the Automatic Transfer Switches as required by the Drawings and as required by these Specifications.
- C. Related work specified elsewhere:
 - 1. Section 26 01 00 General Provisions
 - 2. Section 26 05 00 Raceways and Boxes.
 - 3. Section 26 12 30 Wires, Cables, Splices, Terminations.
 - 4. Section 26 19 50 Identification

1.02 SUBMITTALS

- A. The Contractor shall prepare and submit, in accordance with the Special Conditions, before fabrication and assembly of the equipment, one sepia and six prints of each of the following:
 - 1. Shop drawings showing the front elevation, rear elevation, section views and mounting details.
 - 2. Shop drawings for floor mounted automatic transfer switches shall include the steel wide flange and channel iron mounting base details. All dimensions for rough in work at the site shall be provided. The drawings shall show the channel iron mounting base which shall be provided as part of this Specification and shipped separately to meet "the pouring" schedules.
 - 3. The shop drawings shall show the details of bus, connections, terminals, etc. including the complete ground bus arrangement and enclosure ground connections.
 - 4. Wiring Diagrams:
 - a. Connection diagrams for the wiring of equipment shall be included.
 - b. Interconnection diagrams shall show the wiring to equipment. The terminal block points shall be clearly identified for the external wiring which shall be routed in or out of the cubicles. The wiring diagrams shall provide adequate space at the terminal blocks for the addition of cable and wire designations for the external wiring to be routed in or out of the equipment.
 - 5. Bills of material shall include all items with catalog cuts describing the electrical and physical characteristics of each item.
- B. The Contractor shall submit, for record and distribution in accordance with the Special Conditions, prior to shipment of the equipment, five copies of Operation and Maintenance manuals for each transfer switch.
 - 1. Operation and Maintenance manuals shall include descriptive bulletins and operation leaflets for the protective relays, control relays, and the transfer switch and bypass switch.

- a. Each Operation and Maintenance manual shall be in a three ring hard binder with tabbed sections. The binder cover shall have the project name and equipment name. The lettering shall be block type and shall be a minimum height of 1/2 inch.
 - b. Each Operation and Maintenance manual shall contain the "Record Document" Drawings, complete operating and instruction manuals, spare parts lists, certified test documents, and other special data required for this equipment.
 - c. The "Record Document" Drawings larger than 8 1/2 inches by 11 inches shall be fan folded.
2. Spare parts bulletins shall be included with catalog cuts for each item.
 3. Certified test reports shall include all assembly and subassembly test and inspection reports.

PART 2 PRODUCTS

2.01 GENERAL

- A. Each automatic transfer switch shall be complete with integral bypass isolation switch and accessories, shall be listed by Underwriters Laboratories under Standard UL 1008 (automatic transfer switches) and shall be approved for use on Emergency Systems.
- B. The entire system shall consist of two elements, the automatic transfer switch and the bypass isolation switch and shall be furnished completely factory interconnected and tested.
- C. Each switch shall be as herein specified, for use as shown on the Drawings.
- D. Each automatic transfer switch and bypass isolation switch shall be provided to manually permit convenient electrical bypass and isolation of the automatic transfer switch. Bypass of the load to either the normal (Source 1) or emergency (Source 2) power source shall provide complete isolation of the automatic transfer switch.
- E. The bypass isolation switch shall permit proper operation by one person through the maximum of two handles at a common dead front panel.
- F. For surface or elevated passenger rail stations with two utility sources the following applies:
 1. Transfer switch (normal) or 'Source 1' is CTA "Reliable".
 2. Transfer switch (emergency) or "Source 2" is CTA "Normal".
- G. For subway stations the following applies:
 1. Transfer switch (normal) or 'Source 1' is Platform AC Distribution System.
 2. Transfer switch (emergency) or "Source 2" is Utility.

- H. For locations where a permanent generator is installed:
 - 1. Transfer switch (normal) or 'Source 1' is CTA Utility.
 - 2. Transfer switch (emergency) or "Source 2" is Generator.
- I. Infrastructure design may dictate other (non-bypass) transfer switch designs or connections.

2.02 QUALITY ASSURANCE

- A. Certified laboratory test data on automatic switches of the same design and rating as those involved shall be available to confirm the following abilities.
 - 1. Overload and endurance at 480 Volts AC shall be in accordance with Tables 21.2 and 23.2 of UL-1008 (or comparative tables when new versions of UL editions are issued) when enclosed.
 - 2. Temperature rise tests after the overload and endurance tests at 100 percent rating shall confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits of the specified conductor insulation.
 - 3. Withstand current rating shall be UL listed for the available fault current at the terminals when coordinated with the protective devices. All tests shall be done at 480 Volts and a X/R ratio of 6.6 or less.
 - 4. Transfer switch shall be operable to alternate source after the withstand current tests, with no welding of contacts.
 - 5. Dielectric strength tests shall be in accordance with NEMA ICS 1-109.5 following the UL withstand current tests.
- B. Automatic transfer switches to be tested and listed per latest revision of UL-1008 for use in legally required standby systems.
 - 1. Certified laboratory test data on automatic transfer switches of the same design and ratings shall be available to confirm ratings and abilities.
- C. The control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 472-1974 (ANSI C 37.90 a - 1974) or as amended and the impulse withstand voltage test in accordance with proposed NEMA Standard ICS 1-109.
 - 1. Certified test reports to include all assembly and subassembly test and inspection reports and operational testing shall be provided.

2.03 SEQUENCE OF OPERATION

- A. When the voltage on any phase of the reliable source (Source 1) is reduced to 75 percent of rated voltage or after a reliable source (Source 1) failure for 1 second, a pilot contact shall be closed to initiate transfer to the normal (Source 2) source of power.
- B. When the normal source (Source 1) of power is delivering not less than 90 percent of the normal source (Source 1) rated voltage and 95 percent of rated frequency, the load shall be transferred to the normal source (Source 1). In the event the reliable source voltage is restored to 90 percent prior to the normal source (Source 1) achieving 90 percent of rated voltage and 95 percent of rated frequency, transfer shall not occur.
- C. If the normal source (Source 2) should fail while carrying the load, retransfer to the reliable source (Source 1) shall be made instantaneously upon restoration of the reliable source on all phases.

2.04 EQUIPMENT OPERATION

- A. The automatic transfer and bypass-isolation switch shall provide manual bypass of the load and isolation of all service and load terminals of the automatic transfer switch to permit periodic testing, maintenance, and service of the automatic transfer switch without interrupting power to the load.
- B. The bypass-isolation switch shall be capable of bypassing the load to either source. Load bypass to the automatic transfer switch's connected source shall be effected without load interruption.
- C. Provisions shall be made to assure continuity of auxiliary circuits necessary for the proper operation of the system.
- D. Auxiliary circuits indicating normal (Source 1) connected to load or emergency (Source 2) connected to load shall originate from the bypass switch when the automatic transfer switch is isolated from the load.
- E. The isolation handle shall provide three positions: "Connected", "Test", and "Isolated". The "Test" position shall permit electrical testing of the automatic transfer switch without disturbing the load. The "Isolated" position shall completely isolate the transfer switch from both lines and load without actual removal of the line or load conductors, and allow the removal of the transfer switch for inspection, adjustment and maintenance.
- F. While in the "Test" or "Isolated" positions, the bypass switch shall function as a manual transfer switch to allow load transfer to either source of power regardless of the position or condition of the transfer switch, including the condition when the automatic transfer switch is removed, and without reconnecting the load terminals of the automatic transfer switch.

2.05 DET IL DESIGN REQUIREMENTS

- A. Each automatic transfer switch shall be suitable for use in emergency systems in accordance with Articles 517 and 700 of the NEC and Article 700.23 of the CEC or as amended.
 - 1. Per Article 700.23 (e) of the CEC, an audible alarm on the transfer switch is not required when the transfer switch operation is monitored at the CTA Control Center via the installed location Scada system.
- B. Each automatic transfer switch shall be rated to withstand the RMS symmetrical short circuit current available at the automatic transfer switch terminals with the overcurrent protection, voltage and X/R ratio, of the furnished system. The minimum short circuit rating shall be a minimum of 35,000 symmetrical amperes with an X/R ratio of 6.6 or less.
- C. Each automatic transfer switch shall be mounted in a NEMA Type 12 enclosure, and be provided with a Corbin CAT 60 key and lock.
- D. Each automatic transfer switch and bypass isolation switch shall be furnished behind separate doors or utilizing barriers or shutters if shared door to mitigate operator exposure. Switch and accessory devices shall be with the ampere rating and the number of poles shown on the Drawings.
- E. Each automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. The automatic transfer switch shall be mechanically held and electrically operated by a single-solenoid

mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw; the switch shall be mechanically interlocked to ensure only one of two possible positions - normal or emergency. The automatic transfer switch shall be suitable for use with emergency sources such as a second utility source.

- F. All main contacts shall be of silver composition and be specifically designed by the transfer switch manufacturer for repetitive load transfer service. They shall be protected by arcing contacts in sizes above 400 amperes. They shall be of the blow-on configurations and of segmented construction in ratings 600 amperes and over. The operating transfer time in either direction shall not exceed one-sixth (1/6) of a second.
- G. All contacts, coils, springs and control elements shall be conveniently removable from the front of the automatic transfer switch without major disassembly or disconnection of power conductors.
- H. The control module shall be supplied with a protective cover and be mounted separately from the transfer switch (within the same enclosure) for ease of maintenance. Sensing and control logic shall be solid-state and mounted on plug-in printed circuit boards. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug-in type with dust covers.
- I. The cable harnesses shall be provided between the automatic transfer switch and control panel and shall be provided with built-in disconnects for routine maintenance.
- J. Automatic transfer switches utilizing components of molded-case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable (e.g. - multiple over center toggles, driven by Linear motors-gear head motors).
- K. Three pole switches shall be used for three phase service. Neutral conductor terminal lugs shall be provided as required for the power system. For 3 phase 4 wire 480/277 volt systems 1000 amp and larger or where the service disconnect is provide with ground fault protection neutral isolation is required. A fourth pole switching neutral shall be provided.
- L. Each automatic transfer switch control panel shall utilize solid-state sensing on normal (Source 1) and emergency (Source 2) for automatic, positive operation.
 - 1. All phases shall be monitored line to line. Close differential voltage sensing shall be provided. The pick-up voltage shall be adjustable from 85 percent to 100 percent of nominal, factory set at 90 percent. The drop-out voltage shall be adjustable from 75 percent to 98 percent, factory set at 80 percent.
 - 2. Each switch shall have a one second delay to allow for an override of momentary source outages, and to delay all transfer switch signals. The time delay shall be field adjustable from 1 to 6 seconds, factory set at one second.
 - 3. The transfer to emergency (Source 2) associated with the stand-by source activation and the one second delay of the starting pilot contact will be initiated upon reduction of the reliable source (Source 1) to 80 percent of nominal voltage and retransfer to the reliable (Source 1) shall occur when the reliable source (Source 1) restores to 90 percent of nominal.
 - 4. Each switch shall have a time delay on retransfer to the reliable source which shall be automatically bypassed if the normal source fails and the reliable source is available. The time delay shall be field adjustable from 0 to 30 minutes, factory set at 30 minutes.
 - 5. A time delay on each transfer switch shall be furnished to transfer to the alternate source (Source 2) of power. Time delay allows for controlled timing of load

- transfer to emergency (Source 2) and shall be field adjustable from 0 to 5 minutes. Factory setting shall be zero.
6. Each automatic transfer switch shall be provided with independent single phase voltage and frequency sensing of the emergency source (Source 2). The pick-up voltage shall be adjustable from 85 percent to 100 percent of nominal. Transfer to emergency (Source 2) upon normal source (Source 1) failure when emergency source (Source 2) voltage is 85 percent or more of nominal and frequency is 95 percent or more of nominal.
 7. Each automatic transfer switch shall be provided with LED pilot lights to indicate source availability as determined by the pickup and dropout settings.
 8. Each automatic transfer switch shall be provided with a LED signal light to indicate when the automatic transfer switch is connected to the reliable source (Source 1). A LED signal light shall indicate when the automatic transfer switch is connected to the emergency (normal) source (Source 2).
 9. Each automatic transfer switch shall be provided with two auxiliary contacts (1-normally open and 1-normally closed) associated with the reliable position when the reliable source (Source 1) main contacts are closed. Two auxiliary contacts (1-normally open and 1-normally closed) shall be provided with each automatic transfer switch to operate in the emergency position when the emergency stand-by source main contacts (Source 2) are closed. Contacts shall be rated as a minimum 10 amps @ 250 VAC or 30 VDC.
 10. Each transfer switch shall be provided with (2) single pole double throw auxiliary contacts which operates when the transfer switch has reliable (Source 1) power available and (2) single pole double throw contacts which operates when transfer switch has normal (Source 2) power available.
 11. A test switch, mounted to the enclosure cover to momentarily simulate normal source failure shall be provided.
 12. A low voltage reset switch to bypass time delay on retransfer to normal shall be provided and shall be mounted on the transfer switch enclosure door.
 13. Test and retest switches may be supplied as part of the door mounted microprocessor control panel.
- M. Each bypass isolation switch shall be provided with a transfer bypass status panel with the following LED indicating lights:
1. Source 1 Available.
 2. Source 2 Available.
 3. Bypass Source 1 (Bypass normal closed).
 4. Bypass Source 2 (Bypass Emergency Closed).
 5. ATS in Test Location.
 6. ATS in Isolate Location.
 7. ATS Inhibit (GE/Zenith).
 8. DS Inhibit (GE/Zenith).
 9. ATS Connected (ASCO).
 10. Load Connected (ASCO).
- N. Auxiliary contacts for remote indication shall be provided as follows:
1. N.O./N.C. Contact when Bypass in Source 1.
 2. N.O./N.C. Contact when Bypass in Source 2.
 3. N.O./N.C. Contact operates when ATS in Isolated Position.
 4. N.O./N.C. Contact operates when ATS in Test Position.
 5. N.O./N.C. Contact when ATS not in Auto.
- O. A low voltage amber light shall be provided which shall be wired to flash whenever the isolation switch is not in the "Closed" position. An extra set of auxiliary contacts (1-

normally open and 1-normally closed), rated 10 amperes at 480 volts AC shall be provided for remote indication.

P. Construction:

1. Each automatic transfer and bypass-isolation switch shall be the product of one manufacturer and be completely factory interconnected and tested so that only the service and load connections to the bypass-isolation switch are required for field installation. All interconnections between the transfer switch, bypass switch and isolation switch shall be by silver-plated copper bus bar.
2. A visual position indicator shall be provided to indicate bypass-isolation switch positions, and availability of normal and emergency sources. A prominent and detailed instruction plate shall be furnished for convenient operation. Enclosure construction shall be in accordance with UL and NEMA standards for industrial controls.

- Q. The equipment manufacturer shall make available, a warranty and service center, with factory trained and certified technicians on a 24-hour basis.

2.06 NAMEPLATES

- A. The name of the driven equipment shall appear on each switch, relay, timer and control device.
- B. Noncorrosive nameplates shall be laminated plastic with 3/8 inch black letters on a white background and shall be mechanically affixed to the front of each door with self tapping stainless steel screws. This shall not change the NEMA rating of the enclosure. The first nameplate shall designate device nomenclature and the second nameplate shall identify sources.
- C. Nameplates shall be installed to designate the purpose of all switches, timers, instruments, relays, fuses, control devices, etc.

2.07 CABLES TERMINATIONS AND TAGGING

- A. Compression type cable lugs for terminating feeder cables and equipment manufacturers cable within each automatic transfer switch entering and leaving the enclosed structures shall be furnished and installed by the equipment manufacturer.
- B. Feeder compression connectors shall be copper, long barrel, tin plated, closed and compression type. The barrel for each cable lug shall be sized for the exact cable size specified. Copper type connectors and terminations shall be furnished. Aluminum-copper type are not acceptable. Acceptable manufacturers shall be Anderson Type VHCL, Burndy type YA, Panduit Series LCB or LCC, Thomas and Betts Series 54800 and 54900, or approved equal.
- C. Termination for Number 8 AWG to 1/0 AWG wire shall be with standard barrel one hole high conductivity seamless copper lugs with inspection holes to assure adequate wire insertion. The tongue shall be stamped with wire size, UL & CSA logos and manufacturer. The base part number and stud size should also be stamped on the tongue to assure adequate identification in application. Barrels shall contain color coded rings, die color code and/or number. Crimp locations shall be indicated to assure correct installation. For further identification, the manufacturer should also be included on the barrel. Type shall be Panduit Series LCB or LCC Power Connectors or Burndy Type YA, or approved equal.

- D. Number 2/0 AWG and larger wire shall be terminated with long barrel, two hole high conductivity seamless copper lugs. Barrels shall contain color coded rings knurled markings indicating die color code, die index numbers, and crimp locations to assure correct usage and installation. For further identification, the manufacturer should also be included on the barrel. For Number 2/0 to 250 MCM sizes, the tongue may be stamped with wire size, UL & CSA logos and manufacturer. The base part number and stud size should also be stamped on the tongue to assure adequate identification in application. Type shall be Panduit LCC series Power Connectors or Burndy Type YA, or approved equal.
- E. Supports shall be provided for all power and control cables.
- F. All cable, primary and secondary, shall enter from the top or bottom. Provisions to support incoming leads and sufficient room to terminate shall be provided.
- G. Cable/wire markers shall be installed on both ends of all conductors both for internal and external cables.

2.08 CONTROL DEVICES AND WIRING

- A. Control devices, local instrument cables, and wiring required on the equipment shall be furnished and installed at the factory.
- B. All small wiring for control or accessory equipment shall be installed in code approved wireways.
- C. Internal control wiring size and rating will be as used and listed in the manufacturers UL file.
- D. All external control and alarm wiring shall be terminated at terminal blocks.

2.09 PAINTING

- A. All interior and exterior seams shall be carefully filled and sanded smooth for neat appearance. The equipment manufacturer shall remove oils and dirt to form a chemically and anodically neutral conversion coating, to improve the finish-to-metal bond, and to provide resistance to rust. All surfaces shall be phosphatized before any of the protective coatings are applied. The final coat for non-stainless steel surfaces shall be baked semi-gloss enamel to provide adhesion, resiliency, durability, color stability, and stain resistance.
- B. The exterior surface of all non-stainless steel structures shall be thoroughly cleaned and given a coat of primer and a finish coat of the equipment manufacturer's Standard of ANSI Standard light gray color Number 61.
- C. The interior surface of all non-stainless steel surfaces shall be given a primary coat and a finish coat of ANSI Standard light gray color Number 61.
- D. The equipment manufacturer shall provide an adequate supply of touch-up paint in aerosol cans.

2.10 MANUFACTURERS

- A. Standard automatic transfer switches shall be ASCO Series 300 or GE/Zenith Model ZTS. Automatic transfer bypass-isolation transfer switches shall be ASCO Series 7000 or GE/Zenith Model ZBTS or approved equal. The equipment shall be as manufactured

and assembled by the Automatic Switch Company Model 962, Russell Electric, Inc.
Model RTB, GE/Zenith ZBTS, or approved equal.

PART 3 EXECUTION

3.01 FACTORY TEST

- A. Each automatic transfer switch shall be completely assembled wired, adjusted and tested at the factory. After assembly, the complete Automatic Transfer Switch will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment.
- B. The main circuits shall be given a dielectric test of 2200 volts AC for one minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 2200 volts AC for one minute between live parts and ground.
- C. The complete automatic transfer and bypass switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- D. The complete automatic transfer and bypass switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.
- E. Certified test reports shall be provided.

3.02 INSTALLATION

- A. The Contractor shall install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's specifications.
- B. Final adjustments to the equipment shall include verification of the proper mechanical operation, verification of the instrument operation and setting of the protective relays and devices.
- C. Service Engineer:
 - 1. The equipment manufacturer shall provide a qualified factory trained service engineer to provide technical direction for the installation and final adjustments of the equipment.
 - 2. The service engineer shall certify that the equipment has been installed in accordance with the manufacturer's specifications.
 - 3. The service engineer shall be available as long as his services are requested, but in any case he shall be required for a minimum of one full 8 hour working day for each Automatic Transfer Switch.
- D. Each floor mounted Automatic Transfer Switch shall be installed on a 4 inch high steel reinforced concrete pad and isolated when stray current control isolation is required.
- E. Each wall mounted Automatic Transfer Switch shall be supported from the wall with "C" shaped channel. The channel shall be fiberglass when isolation for stray current control is required, and hot dipped galvanized for normal conditions. The minimum separation between the equipment and the wall shall be one inch.

3.03 TRAINING

- A. The equipment manufacturer shall provide factory trained technicians at the job site to provide adequate training for the Authority's Personnel in the proper operation and maintenance of the equipment.
- B. The training classes shall be done at on-site locations selected by the Authority.
- C. A minimum of 8 man-hours shall be provided for each automatic transfer switch.

END OF SECTION 26 25 10

SECTION 26 33 53
UNINTERRUPTIBLE POWER SUPPLY SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies the UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM required under this Contract.

1.03 RELATED WORK

- A. Section 26 01 00, General Provisions
- B. Section 26 05 00, Raceway and Boxes
- C. Section 26 12 30, Wires, Cables, Splices, Terminations
- D. Section 26 19 00, Grounding
- E. Section 26 19 50, Identification
- F. Section 26 46 00, Dry Type Transformers
- G. Section 26 95 00, Electrical Testing
- H. Except as modified herein, the work must be performed in accordance with the applicable requirements of Special Conditions for Transportation Construction, and Additional Special Conditions, as well as the requirements of the General Conditions, Division 1, and this Section.

1.04 SUBMITTALS

- A. Furnish shop drawings for the fabrication and installation of the Work. Prepare layouts in plan at not less than 1/8" = 1'-0" scale and equipment room plans not less than 1/4" = 1'-0". Include the following:
1. Nameplate legends both for external and internal mounting.
 2. Dimensional data and weights.
 3. Installation details.
 4. Single line and wiring diagrams, complete with connections, symbols and detailed protective and operative device schedules, control schematic diagrams, and relay and metering schematic diagrams.
 5. Mimic bus diagram.
 6. Operation information and ratings including cooling load.
 7. Optional equipment.
 8. Connection wiring diagrams for the equipment.
 9. Interconnection diagrams must show the wiring to the equipment in other sections.
 10. Bills of material must include all items with catalog cuts describing the electrical and physical characteristics of each item.
 11. Battery layout, battery sizing calculations.

12. Front, rear, and side elevations depicting where all components are mounted and located, including the outline of instrument transformers.
 13. Drawings and section views including channel iron mounting base details. Furnish dimensions for rough-in work at the site. Show the channel iron mounting base.
 14. Drawings showing the details of bus, connections, terminals, etc., including complete ground bus arrangements and enclosure ground connections
- B. Maintenance, Operating, and Service Manuals
1. Submit maintenance and operating manuals.
 2. Furnish official factory produced service manuals complete with circuit board level schematics. If "technical support" is available provide call in number and authorization ID as necessary. If the UPS design requires password for testing maintenance settings, provide all passwords for all access levels.
 3. A Bill of Material (BOM) containing part numbers for all components in the UPS for ID and ordering purposes. List shall also contain the component life expectancy and the mean time between failure rating (MTBF).
 4. If training classes are required to obtain service manuals, the cost of class room training, travel. Hotel and meals for up to four(4) city of Chicago transportation officials shall be included to be used up to one (1) year from the date the owner officially acquires the UPS
 5. Manufacturers spare parts recommended list
 6. Manufacturers maintenance recommendations.
 7. Drawings, schematics, and bill of material should all use same part designations.
- C. Furnish material list with technical data documenting the primary function, quality, and performance of each system to be used in the Work, e.g., the load ratings or other such primary characteristics as required by the Drawings or Specifications. Furnish a listing for each of the following.
1. Uninterruptible power supply systems.
 2. Batteries, including battery layout and battery sizing calculations. Include calculations which reflect that the battery system has 20% more electrolyte than required for normal design.
 3. Power distribution centers.
 4. Isolating transformers.
- D. Furnish manufacturer's literature describing the general properties of each product to be used in the Work.
- E. Furnish Quality Control Testing and Inspection Reports for the specified Quality Control inspections and tests.
- F. Furnish record drawings annotated with the changes made during installation of the Work so as to be a complete set of "as installed" plans and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Contractor is solely responsible for quality control of the Work.
- B. Comply with applicable requirements of the laws, codes ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from such authorities. UL 924 listing to be provided as necessary to meet requirements of this spec. The UPS system shall comply with UL 924 using a 10 year life battery (even though system requirement is a 20 year life battery system)

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in materials in manufacturer's original packaging labeled to show name, brand, type and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do no open packaging nor remove labels until time for installation.

1.07 WARRANTY

- A. Special Warranties:
 - 1. Furnish 5 year written warranty in form stipulated by Authority, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Authority.
 - 2. Batteries tot also have a 5 year full unconditional and a 15 year pro-rata limited warranty by the manufacturer that the batteries must operate at full rated capacity without maintenance or service under otherwise normal operating conditions. Warranty must make such guarantee(s) to the effect that if any battery or cell fails to hold the full rated charge or requires maintenance or service to, replace batteries to the satisfaction of the Authority.

1.08 MAINTENANCE

- A. Furnish complete operating and maintenance manuals describing the materials, devices and procedures to be followed in operating, cleaning and maintaining the Work. Include manufacturers' brochures and parts lists describing the actual materials used in the Work. Assemble manuals for component parts into single binders identified for each system. Include the following:
 - 1. Instruction booklets must include descriptive bulletins and operation leaflets for the protective relays, control relays, operating switches and maintenance procedures for circuit breakers.
 - 2. Each instruction manual must be in a three ring hard binder with tabbed sections. Binder cover must have the project name and equipment name. Lettering must be block type and must be a minimum height of 1/2".
 - 3. Each instruction manual must contain the "as installed" drawings, complete operating and instruction manuals, spare parts lists, certified test documents, and other special data required for this equipment.
 - 4. "As Installed" drawings larger than 8-1/2" by 11" must be fan-folded.
 - 5. Spare parts bulletins with catalog cuts for each item.
 - 6. Connection diagrams for external cabling.
 - 7. Equipment internal wiring diagram.
 - 8. Instruction manuals including as a minimum the following:
 - a. Installation procedures.

- b. Operation procedures.
 - c. Servicing procedures.
 - d. Troubleshooting instructions.
 - e. Construction Details.
 - f. Service Supplement Manual covering all detail servicing requirements.
9. Certified copies of the final test report.
- B. Prior to Authority's acceptance, establish with the Authority an instruction and training program for the Authority's personnel. Notify the Authority in writing at least 7 days prior to commencement of the program, and furnish an outline of the instruction topics correlating with the maintenance and Operating Manual. Provide a qualified instructor and a 6 hour training period scheduled during a normal 8 hour working day. Instruction and training includes, but is not limited to, the following.
1. Use of the Maintenance and Operating Manual to maintain and operate the Work.
 2. Authority's responsibilities for maintenance of the warranties.
 3. Demonstrating operation in accordance with the Contract Documents.
- C. Training:
1. Equipment manufacturer must provide the factory trained technicians at the job site to provide adequate training for the Authority's personnel in the proper operation and maintenance of the equipment.
 2. Training classes must be done at on-site locations selected by the Authority. Equipment manufacturer must provide a "High Quality" training DVD.
 3. Equipment manufacturer must provide all video equipment and a video recording of all training classes on a standard DVD. This DVD recording must be submitted to the Authority for review.
 4. If the Authority determines that the DVD is not of "High Quality" for the future or refresher training, the equipment manufacturer must make another video recording of another training class at no cost to the City.
 5. Equipment manufacturer must provide their service engineer for minimum of 24 man-hours of training which must be provided for each type and size of UPS system.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Cyberex
- B. LTI
- C. DSPM
- D. or approved equal

2.02 SYSTEM DESCRIPTION

- A. UPS system to consist of a UPS module, storage batteries, and a batter disconnect breaker. AC output of the UPS module to be connected to the critical loads. Connect storage battery to the DC input of the UPS module through a battery disconnect breaker.
- B. AC power must be connected to the normal source AC input of the UPS module. AC power to be connected to the alternate AC input of the UPS module to provide power to the critical loads during maintenance. Alternate AC input must match the UPS output in voltage, phasing and ampacity.
- C. Critical loads are those loads which require regulated continuous AC power and which are connected to the output of the UPS module.
- D. UPS system configuration to be a single UPS module rated to supply the full load for a minimum of 90 minutes. Oversizing the UPS to accomplish this rating is not accepted.
- E. Equipment to be suitable for installation indoors with ambient temperature range of 0 to 40°C and relative humidity of 0 to 95%, non-condensing.
- F. Power components to be sized with 30% or more safety margin to reduce components stress and increase the overall systems useful life.

2.03 SYSTEM DESIGN

- A. The UPS to be a 20 year industrial design. System to use components of adequate rating to provide and expected service life of twenty years continuous duty and ten years without component replacement and a 150,000 hours MTBF (mean time between failures). System ist not contain continuously moving parts other than cooling fans which must have permanently lubricated bearing.
- B. Provide provisions for testing the control circuits while the critical loads are bypassed to one of the power sources. Adjustments and tests to be possible with the use of a standard volt-ohm-milli-Ampere meter and oscilloscope. Test points and diagnostic lights to be provided to allow easy adjustment of the controls.
- C. Control circuits to be mounted on etched circuit boards with plug-in connections for ease and speed or repairs. Printed circuit boards to be conformal coated prior to component mounting as to not inhibit replacement and/or thermal venting properties. As well as to protect against moisture, foreign particles and dust.
- D. Cooling to be by natural convection, or forced air by fans. If forced air fans are provided, small particulate air filters along with a low air pressure sensor with alarm contacts to be provided.
- E. The UPS to be designed to work with a 10 to 20 year life battery
- F. UPS to be able to discharge the battery to 90% of charge in 10 times the discharge
- G. Strip heaters and fans to be included in enclosure to counter condensation.

2.04 SYSTEM OPERATION

- A. Under normal conditions the inverter is to supply AC power continuously to the critical loads through the static transfer switch. Inverter output to be synchronized with the alternate AC power source provided that the alternate AC power source is within the specified frequency range. Rectifier-charger to convert the normal AC input power to the

DC power for the inverter and for float charging the storage batteries.

- B. On loss of normal AC input power, the storage batteries to supply DC power to the inverter so that there is no interruption of AC power to the critical loads whenever the normal AC input power source of the UPS module deviates from the specified tolerances or fails completely. Batteries to continue to supply power to the inverter for the specified protection time.
- C. On return of normal AC power source, the rectifier-charger to start and assume the DC load from the batteries. Rectifier-charger to then simultaneously supply the inverter with the DC power and recharge the storage batteries. This to be an automatic function and to not cause disturbance to the critical loads.
- D. Transfer to the alternate source to occur when the static transfer switch senses and overload, an inverter shutdown signal, or degradation of the inverter output. Static transfer switch to automatically transfer the critical loads from the inverter output to the alternate AC power source without an interruption or power. If the alternate AC power source is below normal voltage limits, then the transfer to be inhibited.
- E. Static transfer switch to automatically retransfer the load back to the inverter after the inverter has returned to normal voltage and stabilized for a period of time. Retransfer to not occur if the two sources are not in phase.
- F. If batteries are taken out of service for maintenance, they to be disconnected from the rectifier-charger and inverter by the battery disconnect breaker. UPS to continue to function and meet all the performance criteria specified herein except for the battery reserve time capability.

2.05 EQUIPMENT REQUIREMENTS

- A. UPS Module:
 - 1. UPS module contains the rectifier-charger, inverter, static transfer switch, maintenance bypass switch, controls, instruments and indicators.
 - 2. UPS Input Module:
 - a. UPS module normal source input to be 208 VAC, three phase, 3 wire.
 - b. Voltage range to be +10% or -15% with equalizing capabilities.
 - c. The frequency to be 60 hertz +/- 5%.
 - d. Current walk-in to ramp up to full load in 15 seconds.
 - e. Magnetizing sub-cycle inrush current to not exceed four times the maximum peak current during recharge.
 - f. Current limit to not exceed 125% of full load input current.
 - g. Power factor to be 0.85 lagging at nominal input voltage.
 - 3. UPS Module Alternate Input: 120 VAC, 1 phase, 2 wire, 60 hertz.
 - 4. UPS Output Module:
 - a. UPS output module to be 120 VAC, 1 phase, 2 wire, 60 hertz.
 - b. Power rating to be 10 kVA at 1.0 or unity power factor.
 - c. Voltage regulation of +/-1% nominal for any of the following conditions:
 - 1) No load to full load.
 - 2) Lagging power factor from 1.0 to 0.8.
 - 3) Minimum to Maximum DC input voltage.
 - 4) Ambient temperature rate from 0 to 40°C.

- d. Voltage transient response to be 10% maximum deviation (average over 1/2 cycle) with recovery to within 5% after 1/2 cycle for 100% load application or removal.
- e. Voltage adjustability to be +/-5%.
- f. Voltage unbalance to be 5% maximum, line to line or line to neutral, with 100% load unbalance.
- g. Phase separation of 120 degrees +/-5 degrees with 100% load unbalance.
- h. Harmonic distortion of 5% total harmonic distortion (THD) maximum for proposed loads.
- i. Frequency stability to be +/-0.1% free running.
- j. Frequency slew rate to be 1.0 hertz per second maximum.
- k. Frequency adjustability to be +/-2 hertz.
- l. Overload capacity of the static bypass switch to be:
 - 1) 125% continuous for 60 minutes.
 - 2) 150% for 10 seconds.
 - 3) 400% for 1 second.

B. Rectifier-Charger:

- 1. Rectifier-charger converts the normal source of AC input power to DC power for the inverter input and for charging the storage batteries. Rectifier-charger consists of an input circuit breaker, isolation transformer, surge suppressors, and a solid-state three phase rectifier with control circuitry to provide constant voltage-constant current regulation and a ramping current walk-in or start-up of the rectifier-charger.
- 2. Overcurrent Protection:
 - a. Rectifier-charger input to be protected by a circuit breaker. Breaker to be equipped with a non-automatic circuit wired to a set of terminal blocks.
 - b. Rectifier-charger output to be fused and electronically current limited to protect connections to the inverter input to prevent damage to the batteries.
- 3. Input Transformer:
 - a. Three phase isolation type with copper windings.
 - b. Transformer windings designed with extra leakage reactance to minimize notching of the input power lines due to SCR commutations.
 - c. Transformer core designed to limit subcycle magnetizing inrush currents to four times the maximum peak input currents during battery recharge.
 - d. Class F transformer winding insulation.
 - e. Provide surge suppressors on the secondary side of the input transformer to assure proper operation of the input module in the event spikes or surges are present in the normal input power source.

4. Control Circuitry:
 - a. Equip rectifier-charger with control circuitry to provide constant DC voltage regulation of +/-1% for +/-10% AC input voltage change, for +/-5% input frequency change, and for 10 to 100% load variations.
 - b. Control circuitry to electronically current limit the output of the rectifier-charger by dropping the DC voltage whenever the DC current exceeds a preset limit.
 - c. Whenever the AC power is applied to the rectifier-charger, the control circuitry to gradually ramp up the output current over a period of approximately 15 seconds to allow gradual loading of the normal input AC power source.
 - d. Control circuitry to automatically provide a boost (equalize) voltage after a failure of the normal input AC power. Provisions to be made to also manually initiate equalization. Duration of the equalize charge to be controlled by a 72-hour adjustable solid-state timing circuit.
5. Furnish output filtering within rectifier circuitry to limit ripple currents into the battery.

C. Inverter:

1. Inverter to convert DC power, from either the rectifier-charger or the storage battery, to regulated and filtered AC power which is supplied to the critical loads through the static transfer switch. Inverter to consist of DC filter capacitors, DC surge protection, solid state pulse width modulated (PWM) inverter, and control circuitry providing precise AC voltage regulation and electronically controlled current limiting.
2. Overcurrent Protection:
 - a. Protect inverter by fast acting fusing to prevent damage to solid-state devices in the inverter bridges.
 - b. Inverter outputs to be both fused and electronically current limited.
3. Inverter input to have banks of filter capacitors.
4. Inverter input to have DC surge protection to assure proper operation in the event that there are surges or spikes on the inverter input. Inverter input to be protected against a 4000 volt transient for 100 microseconds from a 40 ohm dynamic source impedance.
5. Inverter to be PWM type to minimize the number of power semi-conductors for increased reliability and to provide improved transient response.
6. Provide isolation type output transformer with copper windings and type F insulation.
7. Inverter to have a output filter to limit the total harmonic distortion (THD) of the output voltage to the specified limits.
8. Control Circuitry:
 - a. Provide control circuitry for constant AC voltage regulation as specified.
 - b. Control circuitry to electronically limit the output of the inverter by dropping the AC voltage when the output current exceeds a preset limit.
 - c. Circuitry to provide a low voltage initial start-up of the inverter and ramp up to full voltage in less than 5 seconds.
 - d. Control circuitry to automatically synchronize and phase lock the inverter output to the alternate power source as long as the source is within 60 +/-0.2 hertz. If alternate power source is not within these limits, then control circuitry to break synchronization and lock to an internal oscillator.

- e. Control circuitry to interface with DC low voltage sensor and turn off the inverter at the 1.75 volts per cell level to prevent damage to the battery.
- f. The inverter to shut down on a short to a battery.
- g. Test points to be provided to facilitate adjustments and diagnosis.
- h. Provisions to be made for easily testing logic circuitry without operating the power circuits.
- i. Place light emitting diodes on the circuits for verification of operation.

D. Static Transfer Switch:

- 1. Static transfer switch to automatically transfer critical loads, without interruption, from the inverter output to the alternate AC power source and vice versa in the event of an overload or degradation of inverter performance.
- 2. Static transfer switch to consist of two pairs of Silicon Controlled Rectifiers (SCR's) per phase with each pair connected in inverse parallel (back to back). One set of SCR's to be connected to the inverter while the other set of SCR's is connected to the alternate, or bypass, power source. The outputs of the two sets of SCR's to be connected together and to furnish power to the critical loads.
- 3. If inverter is out of normal limits due to fast or slow under voltage or due to over voltages, the static transfer switch to turn on the alternate source of SCR's to provide power to the loads from the alternate power source. At the same time, the inverter power source to be turned off to prevent the alternated power source from back feeding power to the inverter. If the alternate power source is not within the normal voltage limits, then the transfer to be inhibited.
- 4. Static transfer switch to automatically retransfer the load back to the inverter after the inverter has returned to normal voltage and stabilized for a period of time. This function to be selected by a switch on the system panel. Retransfer to not occur, where initiated manually or automatically, if the two sources are not in phase.
- 5. If an overload is detected, the static transfer switch to operate.
- 6. Place fuses in the inverter and alternate sources of the static transfer switch.
- 7. Static transfer switch to have a surge protection on the alternate source side.
- 8. Static transfer switch to transfer from the inverter to the alternate power source for the following conditions:
 - a. Inverter under voltage, on any phase, to be 90% of nominal.
 - b. Inverter over voltage, on any phase, to be 110% of nominal.
 - c. Inverter over load to be on any phase.
 - d. Blown fuse in the inverter.
 - e. Manual signal.
- 9. Static transfer switch to inhibit transfer to the alternate source if the alternate source voltage is less than 80% of nominal on any phase.
- 10. System to automatically retransfer the load to the inverter provided all of the following conditions are met:
 - a. Inverter and the alternate source to be in phase.
 - b. Inverter voltage to be within +/-10% of nominal for more than five seconds on all phases.
- 11. Maximum transfer sensing time for loss of inverter voltage to be 1/4 cycle.
- 12. Maximum transfer time to switch from inverter to alternate power source to be 100 microseconds.

E. Maintenance Bypass Switch:

- 1. Maintenance bypass switch to connect the alternate AC power source to the

critical loads while electrically isolating the static transfer switch and inverter for the maintenance purposes.

2. Provide a manually operated maintenance bypass switching arrangement which permits bypassing critical loads to the alternate AC power source without interruption of power to those loads, and at the time, electronically isolates the static transfer switch and inverter from the alternate power source.
3. Switch will not be able to be turned to bypass position unless the UPS is being fed from the alternate source.

F. Battery System:

1. Storage batteries to supply DC power to the inverter input when the normal AC input power to the UPS module fails or the rectifier-charger fails.
2. Battery voltage system to be as required by the inverter.
3. Size battery system to operate for 2 hours at 25°C at full inverter output rating.
4. Battery Enclosure:
 - a. Each battery cabinet to be sized to accommodate replacement batteries.
 - b. There is to be a minimum of a 9 inch clearance from the top of any battery terminal to the bottom of any shelf above.
 - c. Shelf width to be one more battery width than the battery quantity that is being installed.
 - d. Shelf depth to be one more battery depth than the battery quantity that is being installed.
 - e. Batteries to be housed in a separate enclosure from the UPS.
 - f. Battery shelves to be of the drawn out type to the width/depth of the shelf.
5. Batteries to be a 20 year rated lead calcium, non-hydrogen emitting, maintenance free, VRLA type rated at 2.25VPC with as many batteries as necessary to make up the DC buss voltage of the UPS.
6. Operate each battery in temperatures from 0°C to 40°C. Battery system to supply sufficient power to provide 90% of nominal specified inverter output performance while operating in 0°C ambient temperature. Battery to be able to safely operate from 0-40°C.
7. Battery voltages to be as follows:
 - a. Floating: 2.25 volts per cell.
 - b. Boost (equalize): 2.40 volts per cell.
 - c. End cell voltage to be no less than 1.75volts per cell.
8. Furnish storage batteries with racks connecting hardware, and standard service accessories. Deliver the batteries charged and filled, ready for service.
9. Battery Terminations:
 - a. Batteries to be interconnected using flexible jumper cables. Bus bar connections to not be allowed.
 - b. Batteries to have top mounted terminals. Terminals to be either 5/16 or 3/4 type terminal connection, flat top.
10. Verify that battery cabinet fits in the designated room.

- G. Battery Disconnect: Battery disconnect to be a molded case circuit breaker used to electrically isolate the storage battery from the UPS module for maintenance purposes and to provide overcurrent protection at the storage battery output. The breaker to be equipped with a non-automatic circuit wired to a set of terminal blocks. The breaker to be integral to the UPS module.

2.06 CONTROLS

- A. The following controls to be included in the UPS module cabinet for the Rectifier-Charger. Each pushbutton to be oil-tight, heavy duty.
1. Input non-automatic circuit breaker
 2. DC Float voltage adjustment
 3. DC boost (equalized) voltage and adjustment
 4. Boost (equalized) voltage timer adjustment
 5. Boost (equalized) voltage timer initiate pushbutton
 6. Boost (equalized) voltage timer reset pushbutton
- B. Inverter to have the following controls:
1. Inverter start pushbutton
 2. Inverter stop pushbutton
 3. DC input under voltage shutoff adjustment
 4. Output AC voltage adjustment
- C. Static transfer switch to have the following controls:
1. Test Transfer Switch
 2. Transfer setting adjustment
 3. Maintenance bypass switch

2.07 METERS

- A. Analog Meters to have a minimum accuracy of 2% at full scale deflection. Measure the following parameters individually:
1. DC Voltage of the rectifier-charger.
 2. DC Current of the rectifier-charger.
 3. AC voltage:
 - a. Inverter
 - b. Alternate source
 - c. Load
 4. AC Current of the load.
 5. AC Frequency:
 - a. Inverter
 - b. Alternate Source
 - c. Load

2.08 STATUS AND ALARM INDICATORS

- A. Each indicating light to be of the light emitting diode (LED) type. A push to test pushbutton to be provided to test all the indicating lights. A complete mimic bus to be provided on the front of the panel. Monitor and display the following status and alarm functions on the front of the UPS module cabinet.
1. Status Indicators:
 - a. Synchronization monitor
 - b. Static transfer switch inverter position

2. Alarm Indications: Provide flashing displays for the following with latching memories which persist until manually reset by pushbutton after alarm has cleared.
 - a. On Battery
 - b. Low Battery
 - c. Over Temperature
 - d. DC Over Voltage
 - e. DC Ground
 - f. Sync Disconnect
 - g. Alternate Source Failure
 - h. Static Transfer Switch in Alternate Source Position
 - i. Air Filter Clogged
 - j. AC Input Power Failure
 - k. AC Output Power Failure
 - l. Inverter Failure Alarm

2.09 ALARM FUNCTIONS

- A. The following functions to have alarm contact 4-20 millamp rating available for connection to the remote alarm system. Alarms to latch until reset after the alarm condition has cleared.
 1. "UPS" On Battery
 2. "UPS" Low Battery
 3. "UPS" Over Temperature
 4. "UPS" Alternate Source Power Failure
 5. "UPS" Common Trouble Alarm
 6. "UPS" Air Filter Clogged
 7. "UPS" AC Input Power Failure
 8. "UPS" AC Output Power Failure
 9. "UPS" Open/Short Battery
 10. Inverter Failure Alarm
 11. Static Switch Activated Alarm

2.10 ENCLOSURE CONSTRUCTION

- A. Each enclosure to be a 14 gage steel enclosure with minimum 11 gauge welded steel frame construction NEMA Type 1 requiring access from the front only for all servicing adjustments and connections. Front access to be through a hinged door with a tumbler lock and 3-point latching door handle. Enclosure door to be constructed of 12 gage steel. Rear -hinged doors to be provided for access to the rear.
- B. Enclosure to be primed and painted inside and outside with semi-gloss enamel. Paint color to be manufacturer's standard. Enclosure to stand on lockable casters with removable side and back panels to provide flexibility of installation configuration.
- C. UPS enclosure to be provided with a lining with sound deadening insulation.
- D. Modules and subassemblies to be mounted in open construction style so that each may be easily replaced. Equipment to be constructed so that each power component can be replaced without a soldering iron or special tools.
- E. Cable and conduit connections to be through the top of the cabinet.
- F. Cooling to be by natural convection or forced air by fans. If forced air fans are provided,

small particulate are filters along with a low air pressure sensor with alarm contacts to be provided.

2.11 SOURCE QUALITY CONTROL

A. Factory Testing:

1. Completely assemble, wire, adjust and test equipment at the factory. Rigid inspection before and after assembly to assure correctness of design and workmanship. After assemble, test each UPS system for operation under simulated conditions.
2. The main circuits to be given a dielectric test of 2200 volts AC for one minute between live parts and ground, and between opposite polarities. The working and control circuits to be given a dielectric test of 2200 volts AC for one minute between live parts and ground in accordance with ANSI C37.20.1.
3. Perform a complete set of tests at the factory. Tests include a manufacturer's standard and commercials test, and specific tests as specified, and a complete simulated operational test of the equipment to guarantee successful operation.

B. Factory Witness Testing:

1. Authority will witness test of this equipment at any time during manufacturing, assembling and/or testing. Provide advance notice of a minimum of six weeks prior to the schedule of factory testing to the Authority.
2. Include living, lodging, and transportation expenses for 4 representatives of the City of Chicago for witnessing factory tests. Living expenses to include meals, transportation, motel or hotel (similar or equal in quality to Holiday Inn Motels) for 2 nights, and a car when inspection facilities are out of the City of Chicago.

C. Spare parts to be provided as listed in manufacturers spare parts recommended list.

PART 3 EXECUTION

3.01 EXAMINATION

- #### A.
- Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor to remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- #### A.
- Provide in accordance with the final submittals and the manufacturer's instructions. Verify measurements and dimensions at the project site and coordinate with the work of other trades. Install at location shown, in perfect alignment and elevation, plumb, level, straight and true. Use procedures that will prevent damaging or soiling the Work during installation.
- #### B.
- Final adjustments to the equipment to include verification of the proper mechanical operation, verification of the instrument operation and setting of the protective devices.
- #### C. Service Engineer:
1. Provide a qualified factory trained service engineer to provide technical direction for the installation and final adjustments of the equipment. Furnish a signed field service report after equipment is operational.

2. Service engineer to certify that the equipment has been installed in accordance with the manufacturer's recommendations.
 3. Service engineer to be available as long as his services are requested but in any case he to be available for a minimum of four 8 hour working days for each UPS System.
- D. Install UPS on 6" high steel reinforced concrete pad.

3.03 FIELD QUALITY CONTROL

- A. Site testing to be provided by the manufacturer's field service personnel. Site testing to consist of a complete test of the UPS system and associated accessories. A full load power test including a partial battery discharge test to be provided as part of the standard start-up procedure. This to be accomplished without disturbing existing wiring and completed prior to operation of the site critical load from the UPS output. Test results to be documented, signed and dated for future reference.
- B. Conduct a megger test on the completed equipment grounding system at the system ground bus to endure that the ground resistance does not exceed 5 ohms without chemical treatment or other artificial means.
- C. Comply with the requirements as specified in Division 1.

3.04 ADJUSTING

- A. Upon completion of the Work, replace Work which is damaged or fails to operate as specified. Replace fuses blown during construction.

3.05 CLEANING

- A. Upon completion of the Work, remove unused materials, debris, containers and equipment from the project site. In addition to the initial cleaning procedure required, and not more than 2 days before occupancy by the Authority, clean the Work as recommended by the manufacturer.

3.06 PROTECTION

- A. Protect the Work during the construction period so that it will be without any indication of use or damage at the time of acceptance

END OF SECTION 26 33 53

SECTION 26 40 00
SERVICE EQUIPMENT - PASSENGER STATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies the incoming electrical service equipment required under this Contract.

1.03 RELATED WORK

- A. Section 26 05 00, Raceway and Boxes
- B. Section 26 12 30, Wires, Cables, Splices, terminations
- C. Section 26 19 50, Identification
- D. Section 26 46 00, Dry Type Transformers
- E. Section 26 95 00, Electrical Testing

1.04 ELECTRICAL SERVICE CHARACTERISTICS

- A. The ComEd incoming service will be 208 Volts 3 Phase, 3 Wire, ungrounded or as shown on the drawings.
- B. The station distribution system voltage to be 120/208Y volt, 3 phase, 4 wire. The Service ground for elevated stations to be the elevated structure or as shown on the Contract Drawings. It is imperative that on elevated stations, to maintain stray current isolation, all necessary precautions must be taken to assure equipment grounding is isolated from earth ground. The service ground for grade level or below grade level stations to be earth ground as shown on the Contract Drawings.
- C. Available short circuit current to be obtained by the Contractor from ComEd and incorporated into the new service equipment as applicable.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor to provide the Commonwealth Edison Company metering CT switchboard, metering sockets, and interconnecting conduit as indicated on the Drawings.
- B. For elevated stations, the incoming service conduit from the ComEd service drop to the Service Disconnect located in the electrical room is to be type FRE, as specified in Section 26 05 00, Raceways and Boxes.

2.02 CT SWITCHBOARD

- A. The Contractor to provide, for the "Normal" Service, a free-standing dead-front type, front accessible, low voltage ComEd CT metering switchboard with a incoming service main breaker, and barriered CT compartment as required. Unmetered sub feed breaker with separate meter fitting for concession service maybe included. This breaker is to be fed from the normal service conductors. (Line side of main breaker).
1. The CT compartment to be ComEd approved, cold sequence metering equipment sized for the ampacity shown on the Drawings. The Authority has received special permission from ComEd for the cold sequence metering.
- B. All bus bars to be silver plated copper. Main horizontal bus bars to be mounted with all three phases arranged in the same vertical plane. Bus sizing to be based on 1000 amperes per square inch.
- C. The bus work to include provisions for mounting ComEd current transformers, and potential taps as required by ComEd.
- D. Provide a full capacity neutral bus.
- E. A copper ground bus (minimum 1/4 by 2 inch) to be furnished firmly secured to each vertical section structure and to extend the entire length of the switchboard.
- F. All hardware used on conductors to be high-tensile strength, zinc plated, minimum grade 5. All bus joints to be full overlap, bolt hole pattern per Chicago Code and be provided with flat and split lock washers.
- G. Small wiring, necessary fuse blocks and terminal blocks within the switchboard to be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., to be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
- H. Terminal lugs to be provided for all line and load terminations properly sized for cable sizes as shown on the drawings. Breaker terminals to be provided as copper only when available. All other terminations to be made with copper compression terminals as specified in another specification section.
- I. Lugs to be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors to be provided as indicated on the Drawings.
- J. All control wire to be type SIS, neatly trained and secured with nylon ties. Insulated ring terminals to be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads to first be connected to conveniently accessible short circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard to be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.
- K. Cabinets to be fabricated from a minimum of 12 gage stretcher level steel and to provide not less than 6 inches clear space for wiring gutters at top, bottom and sides, as measured from the breaker.
- L. The seams for each cabinet to be continuously welded at the outside and to be ground smooth, and the cabinet thoroughly cleaned.
- M. For locations exposed to the elements exterior cabinet to be unpolished number 2 mill finish stainless steel type 304 (unless otherwise shown) and built to NEMA 3R

requirements. Interior metals of stainless steel cabinets, doors, covers, panels and equipment mounting brackets to be 12 gage galvanized (or galvaneal) steel. For indoor installations, the enclosure including doors, covers, panels and mounting brackets to be 12 gage galvanized (or galvaneal) steel. All surfaces of the steel cabinets, doors, covers and all internal galvaneal steel parts to be properly cleaned, primed and painted with a finish coat of light gray ANSI 61 paint.

1. NEMA 3R enclosures to include thermostatically controlled anti-condensation strip heater properly sized for the enclosure and drainage holes with insect screens for base mounting equipment or breather drains for surface mounted equipment. Strip heater circuit to be 120 volt AC wired to terminal blocks powered from nearest normal lighting panel.
- N. All free standing cabinets to be securely and adequately supported with approved angle iron and channel type frame work.
- O. Incoming service main breaker to have microprocessor based tripping system per this Specification Section.
- P. Incoming service main breaker and concession service breaker if supplied to be provided with lock-off provisions.
- Q. CT switchboard to be built in accordance with service entrance requirements and be U/L 891 labeled.

2.03 PRIMARY CIRCUIT BREAKERS

- A. The primary service breaker to consist of an enclosed circuit breaker with external operating mechanism capable of being locked off, a zero sequence ground fault system with associated shunt trip, and an under voltage alarm relay mounted in a NEMA 12, NEMA 4X fiberglass enclosure.
- B. Circuit breakers to be heavy duty industrial type of the frame size shown on the Drawings, with microprocessor-based RMS sensing trip units.
 1. Each molded case circuit breaker microprocessor-based tripping system to consist of three current sensors, a trip unit, and a flux-transfer shunt trip. The trip unit to use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection to be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.
 2. Interchangeable rating plugs to establish the continuous trip ratings of each circuit breaker. Rating plugs to be fixed. Rating plugs to be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
 3. The microprocessor-based trip unit to have thermal memory capabilities to prevent the breaker from being reset following an overload condition prior to a preset time delay.
 4. Breakers to have built-in test points for testing the breaker by means of a 120-volt operated test kit. Provide one test kit capable of testing all breakers 400 ampere frame and above.
 5. System coordination to be provided by the following microprocessor-based time-current curve shaping adjustments:
 - a. Adjustable long time pick-up and delay.
 - b. Adjustable short time pick-up and delay, with selective curve shaping.

- c. Adjustable instantaneous pick-up.
 6. Circuit Breakers to be Eaton Series C circuit breakers, with microprocessor-based RMS sensing trip units type Digitrip RMS 310 or approved equal.
 7. Circuit breakers to be provided with auxiliary contacts and trip alarm contact for status indication at station alarm and interface terminal compartment.
- C. The static trip ground fault protection system to consist of the following components designed to operate as a system.
1. A ground fault relay with draw out case construction for ease of maintenance designed to operate on low level ground fault currents, and having an adjustable current pick up of 2 to 24 amperes, and an adjustable time delay of inst. To 1.0 second.
 2. The current monitor to be of the zero sequence window type, with the window size based on the size and quantity of wires passing through it.
 3. A self-contained monitor panel which to include an LED type control power lamp to indicate the presence of control power to the relay system, a ground fault operation target indicator which maintains indication on loss of control power, a test switch for performing an operational test on the relay system, a no-trip switch to prevent the breaker from tripping when the operational test is performed if continuity of service must be maintained, a reset pushbutton to reset the trip target indicator from orange to black.
 4. Ground fault relay to be ABB type GKC catalog number 202R2618UL with associated ground fault current monitor or equal.
 5. A dry type control power transformer rated 250VA, 208-120 volt, 60 HZ. Connected to the load side of the service breaker. The primary winding to be protected with a 2 Ampere fuse.
- D. Provide 208 volt three phase voltage monitoring relay. Relay to be solid state control, with isolated contact outputs, and adjustable pick up and drop out voltage settings. Relay to drop out on under-voltage or phase loss conditions and be self-resetting upon return to normal voltage conditions. Voltage sensing connections to be provided with current limiting control fuses and be connected to line side of service breaker. Indicating contact to be connected to station alarm and interface terminal compartment to indicate utility under voltage or phase loss condition.
- E. One complete set of spare control fuses to be included, identified and mounted within the enclosure.
- F. Assembly to be provided with UL 508 Industrial Control label. Mounting of the required ground fault relay through the enclosure door will void the enclosure rating labels per UL 508 industrial control requirements.
- 2.04 METER CABINET
- A. A lockable meter cabinet enclosure is to be furnished.
 - B. Each cabinet is to be UL listed and IBEW labeled.
 - C. Each cabinet is to be NEMA 4X and shall be wall-mounted single-door, with back panels, similar to Hoffman Engineering Company Type A-12 or equal, as shown in the Contract Drawings, with the following additional requirements:
 1. Enclosures for to be formed of 14 gauge 304 stainless steel minimum, seams continuously welded and ground smooth, without openings or knockouts, with external wall mounting brackets, and collar studs for mounting panel. Back

panels shall be formed of 12 gage galvaneal steel, a rolled lip shall be formed on all sides of the door opening. Size shall be 24 inches by 36 inches by 18 inches deep or as required for the meter base and socket.

2. Doors shall be formed of 14 gauge 304 stainless steel with rolled lip along top and sides to mate with the enclosure. The door shall be fitted with a closed-cell neoprene gasket attached with oil-resistant adhesive and bonding stud.
3. Cabinet door shall be equipped with a concealed full length, stainless steel continuous piano type hinge. Yale Company, Division of Eaton Security Products & Systems, Catalog Number S 1400, or Corbin Cabinet Lock Company Catalog Number 1000 vault handles with disc tumbler locks and three point latch shall be provided on doors twenty-four inches or over in height. Yale Company, Division Eaton Security Product & Systems Catalog Number T 1403, or Corbin Cabinet Lock Company Catalog Number 1001 handles with disc tumbler locks and one point latch shall be provided on doors under twenty-four inches in height.
4. Two keys shall be furnished with each cabinet and lock. All cabinet locks shall be provided to accept a CAT 60 Master Key (Corbin Lock or H. Hoffman Co.). Lock shall be arranged to permit key removal in locked and unlocked positions.
5. Handle will be provided as heavy duty padlockable stainless steel and three point latch suitable for outdoor or subway installations.

2.05 MANUFACTURERS

A. Acceptable manufacturers of service equipment:

1. Illinois Switchboard Corp.
2. Erickson Electrical Equipment Co.
3. Gus Berthold Electric Co.
4. approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to install the equipment in strict accordance with the approved shop drawing and the equipment manufacturer's instructions.
- B. Each surface mounted cabinet to be supported and mounted away from the wall with "C" shaped channel. The channel to be fiberglass, when stray current control isolation is required, and stainless steel for other applications. The minimum separation between the equipment and the wall to be 1 inch.
- C. The equipment to be installed with work space clearances as required by the Code.
- D. The equipment to be installed to permit maintenance and replacement of parts, and to be clear of all openings with swinging or moving doors, partitions or access panels.
- E. Mounting Bases - Concrete:
 - 1. The Contractor to install the floor mounted switchboard on a 4 inch thick concrete housekeeping pad of sufficient size plus at least a 4 inch apron.
 - 2. Each foundation to be level, stable, and compacted to 95 percent Standard Proctor.
 - 3. Switchboards and service equipment installed in electrical rooms located on grade to be electrically isolated from the concrete pad when stray current control isolation is required by the use of isolating pads, sleeves, and washers as specified elsewhere in these Specifications.
 - 4. Entryway or conduit locations to be in accordance with equipment manufacturer's approved shop drawings.

END OF SECTION 26 40 00

SECTION 26 46 00
DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies the furnishing and installing of dry type transformers.
B. The Contractor to furnish and install dry type transformers as shown on the Drawings.

1.03 RELATED WORK

- A. Section 26 01 00, Basic Electrical Requirements.
B. Section 26 05 00, Raceways and Boxes.
C. Section 26 06 00, Grounding and Bonding
D. Section 26 19 50, Electrical Identification
E. Section 26 95 00, Electrical Testing

1.04 QUALITY ASSURANCE

- A. The design, manufacture and testing of dry type transformers and the methods of conducting tests and preparing reports to be in accordance with NEMA Standards Publication for Specialty Transformers, No. ST-20 and UL 1561.
B. Dry type transformers to be energy efficient designs Department of Energy compliant in accordance with Department of Energy 2010 (D.O.E. 10 CFR Part 431) or as amended.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Dry Type Transformers:
1. Each ventilated dry type transformer to be designed for continuous operation at rated KVA without exceeding 115 degrees C. temperature rise above a 40 degree C. ambient. All insulating materials to be in accordance with NEMA ST-20 standards for a 220 degree C. component recognized insulating system.
 2. Transformer core to be constructed with high-grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities to be substantially below the saturation point. The transformer core volume to allow efficient transformer operation at 10 percent above the highest tap voltage. The core laminations to be tightly clamped and compressed.
 3. Transformers rated 15 KVA and below to have the core and coil assembly completely encapsulated in a proportioned mixture of resin and aggregate to provide a moistureproof, shock resistant seal. The core and coil encapsulation

system to be NEMA and UL rated for a maximum temperature of 180 degrees C. and designed to minimize the sound level. Two 5 percent below normal and one 5 percent above normal taps to be provided. Station or infrastructure design may require encapsulated transformers larger than 15 KVA.

4. All ventilated dry type transformers rated 30 KVA and larger to have a core and coil assembly impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly to be installed on vibration absorbing pads. 2 1/2 percent taps, two above and four below normal to be provided. Station or infrastructure design may require ventilated dry type transformers smaller than 30 KVA.
 5. Both high voltage and low voltage windings to be of copper conductors. Aluminum conductors are not acceptable.
 6. Sound levels to be in accordance with NEMA-ANSI standards.
 7. Transformer enclosure designs are dependent on equipment locations and transformer type:
 - a. Enclosures for ventilated dry type transformers located in equipment rooms or in protected areas to be painted sheet steel, self-bracing, drip proof type, solid bottom plates for increased rodent protection, complete with lifting lugs as required. Each transformer to have an electrical ground connecting the core to the enclosure with a flexible ground strap. Ventilating openings to be in accordance with NEMA and UL standards for ventilated enclosures. Bases of large transformers consisting of structural steel members to permit skidding or rolling.
 - b. Enclosures for ventilated dry type transformers located in outdoor areas, unprotected equipment areas, or passenger accessible areas to be Type 304 stainless steel, self-bracing, weather-resistant type, with solid bottom plates for increased rodent protection, complete with lifting lugs as required. Ventilating openings to be provided with Barbara-Coleman style grills (standard weather shields are not acceptable). Additionally, transformers located in passenger accessible areas or outdoor locations to be provided with stainless steel tamper-resistant cover hardware.
 - c. Encapsulated transformers located in equipment rooms or in protected areas to be painted sheet steel, NEMA Type 3R. Encapsulated transformers located outdoors, unprotected equipment areas, or in the subway tunnels to be Type 304 stainless steel. Encapsulated transformers to be mounted in a way that maintains the NEMA 3R equipment rating.
 8. Each transformer to have coils of continuous winding construction. High voltage leads and connections to be insulated, equal to the voltage class of the winding.
 9. Each dry type transformer to be provided with a suitable terminal compartment to accommodate the required primary and secondary wiring connections and side or bottom conduit entrance. Transformers having ratings not exceeding 25 KVA to be provided with terminal leads equipped with Contractor installed connectors arranged and supported in workmanlike manner. Ventilated dry type transformers with terminal boards to be supplied with provisions for NEMA 2 hole lugs for Contractor installed compression type connectors as specified in the appropriate Specification Section. Contractor to mount terminal lugs with zinc plated Grade 5 hardware complete with conical washers.
 10. The terminal compartment temperature to not exceed 75 degrees Celsius when the transformer is operating continuously at rated load with an ambient temperature of 40 degrees Celsius. Transformers having ratings not exceeding 10 KVA to be UL listed for operation with connecting cables rated for use at 75 degrees Celsius.
- B. Ratings to be as shown on the Drawings.

2.02 MANUFACTURERS

- A. Acceptable manufacturers for dry type transformers:
1. Hammond Power Solutions.
 2. Olsun Electronics.
 3. Approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to install the equipment in strict accordance with the approved shop drawings, the equipment manufacturer's recommendations and the contract documents.
- B. Mounting Bases - Concrete:
1. Concrete pads to be 4 inches high, unless otherwise indicated on the Drawings, complete with steel reinforcing and necessary bolts, anchors, etc. Where concrete pad is set directly on concrete floor, dowels in floor to tie base to floor to be provided. These pads to be extended at least 4 inches beyond the equipment outlined on all four sides, unless otherwise indicated on the Drawings.
 2. Each foundation to be level, stable, and compacted to 95 percent Standard Proctor.
 3. Transformers installed in Electrical rooms located on grade to be electrically isolated from the concrete pad by the use of insulating pads, sleeves, and washers.
 4. Entryways or conduit locations to be in accordance with manufacturers approved shop drawings.
- C. Dry type transformers, if not supplied with internal vibration and noise isolating and dampening supports where the core mounts to the frame, to be provided with approved external vibration and noise isolating and dampening pads. The Contractor to make all conduit connections to transformers with flexible liquid tight metal conduit, not less than 18 or more than 36 inches in length, or with approved vibration isolating connections.
- D. Encapsulated transformers to be mounted to maintain NEMA 3R equipment rating.
- E. The Contractor to ground enclosure and neutral conductors as shown on the Drawings.
- F. The Contractor to terminate primary and secondary conductors in accordance with manufacturer's instructions.

END OF SECTION 26 46 00

SECTION 26 47 00
PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 DESCRIPTION

- A. Section Includes:

1. The panelboards, circuit breakers as well as appurtenances thereto required under this contract.

1.03 RELATED WORK

- A. PANELBOARDS specified to be furnished and installed herein have related work in various other sections, including, but limited to:

- | | | |
|-----|----------------|--|
| 1. | Section 260100 | "General Provisions" |
| 2. | Section 260300 | "Electrical Demolition" |
| 3. | Section 260500 | "Raceways and Boxes" |
| 4. | Section 261000 | "Basic Electrical Materials and Methods" |
| 5. | Section 261230 | "Wires, Cables, Splices Terminations" |
| 6. | Section 261410 | "Wiring Devices" |
| 7. | Section 261700 | "Local Control" |
| 8. | Section 261750 | "Local Control Panels" |
| 9. | Section 261900 | "Grounding" |
| 10. | Section 261950 | "Identification" |
| 11. | Section 265010 | "Lighting Fixtures" |
| 12. | Section 269500 | "Electrical Testing" |

1.04 QUALITY ASSURANCE:

- A. Assembled panelboard shall be UL and IBEW labeled.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General:

1. Panelboards to be of the circuit breaker, plug fuse, or fusible switch type, of dead front construction, with the voltage characteristics, bus size, main lugs only or main protective device, and number and size of branch circuits as shown on the Drawings.
2. Panelboards to be recessed or surface mounted as shown on the Drawings, enclosed in a 12 gage steel cabinet with steel trim, and door with concealed continuous stainless steel piano hinges and cylinder type locks.
3. Panelboards to be fully rated, labeled with their UL short circuit rating, and to have a Service entrance label when required by the application.
4. Circuit breakers to be of the industrial, bolt-on type, of the number of poles and rating as shown on the Drawings.

5. Fusible switch units for sizes 30 Amperes through 400 Amperes to be quick-make, quick-break design, with rejection type fuse clips. Switch units 600 Amperes and larger to be of the bolted pressure type with Class L fuses.
6. Panelboards to be designed for sequence phase connection of branch circuit devices to allow for the complete flexibility of circuit arrangement to evenly balanced the electrical load on each phase.
7. Each panelboard to have internally mounted and connected surge protective devices and to meet NEC and UL requirements.

B. Cabinets:

1. Cabinets to be fabricated from a minimum of 12 gage stretcher level galvanealed steel and to provide not less than 6 inches clear space for wiring gutters at top, bottom and sides, as measured from the panel edge or breaker whichever is greater.
2. The seams for each cabinet to be continuously welded at the outside and to be ground smooth, and the cabinet thoroughly cleaned.
3. All free standing cabinets to be securely and adequately supported by approved angle iron and channel type frame work.
4. Doors and trim to be each of one piece, constructed of Number 12 gage galvanealed steel and be designed so that doors will close against a gasketed rabbet. Trims to be fastened with machine screws or bolts fastening to permanently affixed nuts on the cabinet. Self-tapping screws or self-adjusting clamps are not acceptable. Doors and trims to be gasketed.
5. Cabinet door to be equipped with a concealed full length, stainless steel continuous piano type hinge. Yale Company, Division of Eaton Security Products & Systems, Catalog Number S 1400, or Corbin Cabinet Lock Company Catalog Number 1000 vault handles with disc tumbler locks and three point latch to be provided on doors twenty-four inches or over in height. Yale Company, Division Eaton Security Product & Systems Catalog Number T 1403, or Corbin Cabinet Lock Company Catalog Number 1001 handles with disc tumbler locks and one point latch to be provided on doors under twenty-four inches in height.
6. A full size typewritten directory with frame and glass face to be furnished and installed on the inside of the door of each cabinet. The directory frame to be secured to the door without the use of screws or holes.
7. Two keys to be furnished with each cabinet and lock. All cabinet locks to be provided to accept a CTA CAT 60 Master Key (Corbin Lock or H. Hoffman Co.). Lock to be arranged to permit key removal in locked and unlocked positions.
8. Panels associated with fare control equipment to be provided with an additional padlock hasp.
9. Site conditions may dictate other construction.
10. Panelboards located in non-temperature controlled environments, outdoors or in subway areas to be NEMA Type 3R or 4X fabricated from 12 gage type 304 stainless steel, continuously welded seams ground smooth and provided with drip shield and wall mounting brackets, gasketed formed door that closes against formed external return flanges of the enclosure body, continuous stainless steel hinge, heavy duty padlockable stainless steel handle with 3 point catch, 120 volt thermostatically controlled strip heater with barrier. In addition panels located in subway areas to be provided with a breather drain as manufactured by Crouse Hinds or approved equal.

C. Circuit Breakers:

1. Circuit breakers to be of the bolt-in type, industrial heavy-duty, quick-make, quick-break, single or multi-pole of the type specified herein and shown on the Drawings.

2. Circuit breakers to be thermal magnetic type with common handle for a multiple pole circuit breakers. Circuit breakers to be a minimum 100 Ampere frame and through 100 Ampere trip sizes to take up the same pole spacing. Single pole circuit breakers rated at 15 and 20 Amperes to be UL listed as type SWD for lighting circuits.
3. Molded case circuit breakers to provide circuit overprotection with inverse time and instantaneous tripping characteristics. Ground fault protection to be provided where shown on the Drawings.
4. Circuit breakers to be operated by a toggle-type handle and to have a quick-make, quick-break over-center switching mechanism that is mechanically trip free. Automatic tripping of the breaker to be clearly indicated by the handle position.
5. Contacts to be non-welding silver alloy, and arc extinction to be accomplished by means of "DE-ION" arc chutes.
6. Circuit breakers to have the minimum symmetrical interrupting rating capacity as shown on the Drawings.
7. Each panelboard breaker to be connected to the main bus with copper bus bar. Insulated cable is not acceptable.
8. Circuit breakers to be Eaton, Siemens, General Electric, or approved equal.
9. Breakers for Distribution Panels to be full size E or F frame 240 or 480 volt as required. Circuit breakers for lighting and receptacle panels to be 480/277 volt rated Eaton Type GHB or Siemens Type BQD or equal.

D. Lighting Contractors:

1. Photo-Cell controlled lighting contactors to be installed within the respective lighting panels for both normal and reliable platform and station lighting circuits as shown on the contract drawings.
2. Lighting Contactors to be located at the lower portion of the respective panels and be provided with a separate removable trim and door.
3. Lighting contactors to be electrically held, 30 Ampere with the number of contacts and number of lighting contactors as determined by the number of circuits to be controlled. Lighting contactors to be Square D Class 8903 Type LO.
4. Lighting contactors to have a maximum of eight normally closed contacts with the control circuit controlled by a remote photocell and arranged for fail safe operation where a failure of any control component will turn the controlled lighting on.
5. Control circuit to be powered from a 15 Ampere 1 pole breaker in the reliable panel.
6. If only one or two sets of lighting panelboards require lighting contactors the interposing control relays may be located within the Reliable lighting panel. Control relays to be 3 pole double throw, 120 Volt AC, and Octal style base with LED indicating light, test feature, matching socket with screw clamping terminals and hold down spring. Contacts to be rated 1/3 HP at 120 volt AC, pilot duty Class B 300. Relays to be Eaton Type D3PF or Square D Type RPM. Test-Auto switch to be located on the contactor door.
7. If more than two sets of lighting panels requiring lighting contactors are required separate wall mounted specialty local control panel as specified in another section in this division to be supplied.

E. Fusible Switches:

1. Fusible switch units, 30 Ampere through 400 Amperes to be quick-make, quick-break design, rated not less than 200 KAIC with rejection type fuse clips. Switch units 600 amperes and larger to be of the bolted pressure type rated 200 KAIC with Class L fuses.

F. Interiors:

1. Interiors to be completely factory assembled with bolt on devices. The interior to be so designed that circuit breakers can be added or replaced without disturbing adjacent units and without removing main bus connectors, and to be so designed that circuits may be changed without additional machining, drilling, or tapping. Spaces for future breakers to have bussing provided, of the required capacity, for the maximum device that can be fitted into them.
2. All bus to be hard drawn electrolytic copper, having 98 percent conductivity and sized on a basis of 1000 Amperes, maximum, per square inch of cross sectional area.
3. Neutrals, where called for, to be grouped and arranged on a common bus.
4. Each panelboard to be furnished with a full length ground bus drilled and tapped to accommodate a ground cable for each circuit breaker. Cable terminals to be provided.
5. Compression type cable lugs for terminating cables and equipment within the panel and entering and leaving the panel to be furnished by the equipment manufacturer. Copper compression connectors to be crimp, type, long barrel tin plated closed end compression. All connectors to be copper. The barrel for each cable lug to be sized for the exact cable size specified. Copper type connectors and terminations to be furnished. Copper-Aluminum connectors are not acceptable. Connectors to be Burndy Type YA, Panduit Series LCB or LCC, Anderson Type VHCL, T & B Series 54800 and 54900, or approved equal as specified in another section of this division.
6. Breaker terminal lugs to be suitable for copper only cable, if available.

2.02 MANUFACTURERS

- A. Acceptable Panelboard manufacturers shall be Illinois Switchboard Corporation, Erickson Electric, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to install the equipment in strict accordance with the approved shop drawing and the equipment manufacturer's instructions.
- B. Each surface mounted panelboard to be supported and mounted away from the wall with "C" shaped channel. The channel to be fiberglass, when stray current control isolation is required, and hot dipped galvanized steel for normal applications. The minimum separation between the equipment and the wall to be one inch. For exterior or subway locations mounting channel to be stainless steel.
- C. The equipment to be installed with work space clearances required by the City of Chicago Electrical Code.
- D. The equipment to be installed to permit maintenance and replacement of parts, and to be clear of all openings with swinging or moving doors, partitions or access panels.
- E. Each panelboard to be mounted with the top a maximum of 6 feet, 6 inches above the finished floor unless shown otherwise shown on the Drawings.

END OF SECTION 26 47 00

SECTION 26 49 00
GENERATOR TAP BOX

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Section Includes:

1. The furnishing and installing of generator tap box as well as required appurtenances.
2. This Contractor to furnish and install the generator tap box as shown on the Drawings.

1.03 RELATED WORK

- A. GENERATOR TAP BOX specified to be furnished and installed herein and have related work in various other sections, including, but limited to:

- | | | |
|----|----------------|--|
| 1. | Section 260100 | "General Provisions" |
| 2. | Section 261000 | "Basic Electrical Materials and Methods" |
| 3. | Section 261230 | "Wires, Cables, Splices, Terminations" |
| 4. | Section 261900 | "Grounding" |
| 5. | Section 261950 | "Identification" |
| 6. | Section 269500 | "Electrical Testing" |

PART 2 PRODUCTS

2.01 MATERIALS

- A. The Generator Tap Box to be fabricated in accordance with the details contained in the Contract Documents, and to provide adequate and proper space for all wires, connections, terminations, and taps.
- B. Cabinet to be stainless steel type 304. Enclosure:
1. The cabinet to be fabricated from a minimum Number 10 U.S. gage stainless steel continuously welded outside of seams, ground smooth and thoroughly cleaned.
 2. The cabinet to be equipped with mounting lugs, continuous stainless steel piano hinged overlapped double doors on the front, continuous stainless steel piano hinged drop down door on the bottom for temporary generator cable entrance. Doors to be equipped with stainless steel Corbin 1000 lever handle cabinet locks with CAT 60 key and three point latching. Doors to also be provided with stainless steel padlocking provisions.
 3. The cabinet to be a rated Nema Type 3R enclosure.
 4. Specific site requirements may necessitate the addition of floor stands constructed of 10 gage Type 304 Stainless Steel. When permanent conduit connections are to be made through the bottom of the enclosure the enclosure to be designed with extra width for integrated side gutter.

C. Bus Work:

1. Bus bars to be hard drawn silver plated electrolytic copper of 98 percent conductivity, rated at a minimum current density of 1000 Amperes per square inch and to be installed as shown on the Drawings.
2. Insulators to be provided as required and as shown on the Contract Drawings. Standoff insulators for bus bars to be 600 volt rated. Enclosure to be provided with a one inch thick insulated back pan size as shown on the Drawings.
3. Load side lugs for permanent connection to the station distribution system to be provided for cable sizes as shown on the contract drawings and to be provided as long barrel 2 hole for phase and neutral connections and long or short barrel 1 hole for ground connection. Lugs to be copper compression type in accordance with specification. Lugs for temporary connections of generator cables to be current rated specifically designed and approved for use with extra flexible copper emergency cables.

2.02 MANUFACTURERS

- A. The Generator Tap Box to be manufactured by Illinois Switchboard Corporation, Berthold Electric Company, Hoffman or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment to be installed as shown on the Drawings.
- B. Unless otherwise indicated conduit openings as required for the installation of conduits indicated on the Drawings to be provided by the installing Contractor. Conduit connections to be made with weatherproof conduit hubs.
- C. Cabinets to be supported and mounted as shown on the Drawings with stainless steel channels. The minimum separation between the equipment and wall to be one inch.

END OF SECTION 26 49 00

SECTION 26 50 10
LIGHTING FIXTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specifies the methods of construction and installation that apply to lighting fixtures, exit lights, emergency lights, motion sensor switches and accessories required for a complete interior and exterior lighting system at rapid transit stations.
- B. The Contractor to furnish and install all lighting fixtures as shown on the Drawings and indicated on the light fixture schedule.
- C. All fixtures to have UL label or listing.
- D. Fixture catalog numbers specify the standard of quality and appearance required and to represent the basic fixture of that type. Substitutions to the listed acceptable manufactures will not be accepted until the contractor has complied with the requirements of the Related Documents, Submittal Procedures.
- E. Lamps, mounting brackets and mounting hardware for all fixtures to be supplied by the Contractor.
- F. Station House Paid and Unpaid area lighting special pendant mounting bracket and metal divided raceways and stainless steel filler sections between fixtures to be provided by Contractor.
- G. LED light sources and power supplies to be supplied by the approved manufacturer.

1.03 RELATED WORK

- A. Lighting fixtures specified to be furnished and installed herein have related work in various other sections, including, but limited to:

- | | | |
|-----|------------------|--|
| 1. | Section 26 01 00 | "General Provisions" |
| 2. | Section 26 03 00 | "Electrical Demolition" |
| 3. | Section 26 05 00 | "Raceways and Boxes" |
| 4. | Section 26 10 00 | "Basic Electrical Materials and Methods" |
| 5. | Section 26 12 30 | "Wires, Cables, Splices, Terminations" |
| 6. | Section 26 14 10 | "Wiring Devices" |
| 7. | Section 26 17 00 | "Local Control" |
| 8. | Section 26 17 50 | "Local Control Panels" |
| 9. | Section 26 19 00 | "Grounding" |
| 10. | Section 26 19 50 | "Identification" |
| 11. | Section 26 47 00 | "Panelboards" |
| 12. | Section 26 95 00 | "Electrical Testing" |

1.04 WARRANTY

A. Warranty Requirements for All Fixtures:

1. The fixture and all its components to be warranted by the fixture manufacturer to be free from defects in material and workmanship for a period of one (1) year from the date of installation.
2. The Contractor to agree to promptly correct by repair or replacement any defect or failure of compliance that may develop within one (1) year of the date of installation. Any part or material replaced under this warranty to be warranted for additional one (1) year period from the date of replacement.
3. The Contractor's obligation to include reimbursement to the City for any labor, material, transportation or reinstallation costs incurred by the City in making any correction assented to by the Contractor.

B. Additional Warranty Requirements for LED Fixtures:

1. The lamps and driver components (RoHS compliant) of LED fixtures to be additionally warranted by the manufacturer for a period of five (5) years against defects in materials and workmanship that result in a fixture lumen depreciation of 30 percent or greater.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The Contractor to furnish and install all lighting fixtures in strict accordance with the Lighting Fixture Schedule or Lighting Fixture Details as described hereunder or on the Drawings. Fixtures to be complete with all necessary accessories and related work including lamp holders, lamps, ballasts/LED power supplies, starters, LED light sources, prismatic style lens, frames, support, wiring and all connections. The Contractor to provide supports from framework where no finished ceiling occurs.
- B. The Contractor to provide auxiliary supports for mounting fixtures in areas without ceilings (i.e. exposed beams and joists) as may be required for proper installation of fixtures. Such supports to span a minimum of 2 joists for each individual fixture, and to be securely and suitable anchored to same. Fixtures not to be supported from underside of roof deck or built tees except as specifically noted otherwise on the Drawings, the detail to be followed.
- C. Fixtures to bear the Underwriter's Laboratories labels and to be purchased, wired and installed in accordance with regulations applicable to the CEC.
- D. The Contractor to provide adequate protection for fixtures and at completion of the work they to be clean and free of foreign material. Replace all burned out or defective lamps, starters, etc., until such time as the Authority takes complete occupancy of the facility.
- E. All material furnished under this contract to be new and of the best quality practicable for the application.
- F. All fixtures to be constructed to be sturdy and rigid. Fixtures located in public areas at a mounting height of ten feet or less to be designed to be vandal resistant.
- G. Fixtures and all components to be constructed, assembled and fastened for maximum endurance to the vibration present on CTA platforms.

- H. Fixtures to have simple lines and a clean uncluttered appearance. There to be a minimum of exposed hardware.
- I. The fixture to be so constructed, hinged and latched that relamping, ballast replacement, power supply replacement, and LED light source component replacement can be performed safely by one individual from a centrally located ladder, without requiring relocation of the ladder.
- J. Fixtures to be designed and tested to maintain the temperature of all interior components (ballasts, lamps, gaskets, diffusers, etc.) below their respective manufacturers recommended normal operating temperature, for any predictable electrical or environmental operating condition.
- K. Each fixture to be assembled from material components in a careful manner by persons experienced in their line of work. Forming, assembly and subassembly to be accomplished such that all parts come together in the fixture to form a complete, well fitted integrated assembly.
- L. Conduit and wire entries to the fixture to be field drilled by the contractor in the top or end plate of the chassis. Entry to be flush with the top of the fixture.
- M. The entire lens area of the fixture (exclusive of door frame members) to be illuminated. There to be no black or unlit areas including those areas where ballast, power supplies, or sockets are located.
- N. Fixtures and luminaires must be manufactured in the United States and adhere to the ARRA Buy American Compliance Act.

2.02 POWER DISCONNECT FOR FIXTURES

- A. Provide a power disconnect in the conductors supplying the fixture ballast or LED engine.
- B. Disconnect to be self-aligning (polarized) snap in type and to contain three wires, one each for the hot, neutral and equipment ground conductor.
- C. Disconnect to facilitate easy removal of the ballast or LED engine for maintenance and to be prewired by the fixture manufacturer.
- D. Male side of disconnect to be connected to the ballast or LED engine power lead-in wires so that exposed contacts are dead in the disconnected position.
- E. Disconnect to be UL listed. The dielectric strength of the connector to be 1500 volt minimum.

2.03 WIRING FOR FIXTURES

- A. Wire inside fixtures to be copper conductor of ampacity required plus twenty-five percent for continuous load.
- B. Insulation to be rated for 1000 volt AC and to be rated for operation at a minimum 200 degrees C in dry locations.
- C. Provide type FF glass braid insulation.
- D. All connections inside the fixtures to be made with wire nuts rated for a minimum of plus 90 degrees C.

2.04 ON/OFF TOGGLE SWITCH FOR FIXTURES

- A. Provide a power toggle switch in the conductors supplying the fixture power supply.

- B. Toggle switch to contain three wires, one each for the hot, neutral and equipment ground conductor. Toggle Switch to facilitate easy removal of the power supply for maintenance and to be prewired by the fixture manufacturer.
- C. Toggle switch to be UL recognized and CSA approved. The dielectric strength of the connector to be 1000 volt minimum.
- D. Toggle Switch to be installed next to power supply.

2.05 FUSE HOLDER AND FUSE FOR FIXTURES

- A. Fuse holder to have compact through-panel design and facilitate easy replacement of fuse.
- B. Fuse Holder to be rated for 30 Ampere, 600VAC.
- C. Fuse Holder to be UL recognized and CSA approved.
- D. Fuse information 5 Ampere replaceable fuse.

2.06 FLUORESCENT FIXTURES

- A. Fluorescent lamp fixtures four (4) feet in length to be of the type as called for on the Light Fixture Schedule.
- B. All auxiliaries used with fixture to have UL and CBM labels.
- C. Surface mounted fixtures to have top reflector plates and to be so designed so as to limit ballast case temperature to 90 degrees C.
- D. Fluorescent Lamp Ballasts:
 - 1. Provide electronic ballast for light fixtures rated to operate on 120 volt, 60 Hz circuits.
 - 2. Ballast to be securely affixed to the interior of the fixture so that it is not affected by vibrations.
 - 3. The ballast to carry the UL and ETL/CBM labels.
 - 4. The ballasts to be provided with integral leads, color coded to ANSI Standard C 82.11, latest version.
 - 5. All ballasts for fluorescent fixture to be specifically designed for cooler case and capacitor temperatures. Ballasts to be premium grade class "P" as required by the National Electrical Code. Ballasts to be fused when the Drawings show circuiting on 15 or 20 Ampere single pole circuits.
 - 6. Fixture to be designed to limit the ballast case temperature under all predictable operating conditions of the application intended to 90 degrees C.
 - 7. Ballast to be mounted to a heat sink to facilitate removal of heat from fixture.
 - 8. Area of heat sink in contact with exterior metal of fixture to be a minimum of twice the area of the ballast surface in contact with the heat sink.
 - 9. Ballast and wiring connections to be inside the fixture housing and to be easily accessible for maintenance and removable.
 - 10. Ballasts to be automatic resetting type with individual capacitor protection.
 - 11. Electronic Ballast:
 - a. Provide 800 MA high power factor electronic ballast for 6 foot & 8 foot long fixtures as indicated on the Drawings. (For indoor heated areas

- only). Provide electric ballast rated for minus 20 degrees F. for T8HO lamps (outdoor areas) and electronic ballasts for T8 lamp (indoor areas).
- b. The ballast to be rated to start the lamps down to a temperature of minus 20 degrees F.
 - c. The "High Frequency" electronic ballast to operate lamps at a frequency of 20 KHz or higher without visible flicker. The electronic ballast's input current to have Total Harmonic Distortion (THD) of less than 20percent when used with primary lamp. The electronic ballast to have a Power Factor greater than 98 percent when used with primary lamp. The electronic ballast to have Lamp Current Crest Factor of less than 1.7, in accordance with lamp manufacturers' recommendations and ANSI C 82.11. The electronic ballast to support a sustained short to ground or open circuit of any output leads without damage to the ballast.
 - d. The electronic ballast to have an audible noise rating of Class A or better. The electronic ballast to meet ANSI C 82.11 standards regarding harmonic distortion. Ballast to meet ANSI C 62.41 Cat. A for transient protection. The electronic ballast to comply with all applicable state and federal efficiency standards. The electronic ballast to be Advance, Motorola or MagneTek or approved equal. The electronic ballast to carry a five (5) year warranty. Manufacturer to be a full line ballast manufacturer with a ten (10) year history of producing electronic ballasts for the North American Market.
 - e. Electronic ballasts to maintain constant light output over operating ranges of 90 V to 145 V.
 - f. Electronic ballasts to withstand line transients as defined in ANSI/IEEE C62.41 Cat. A, and meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, for non-consumer equipment.

2.07 LED LIGHT SOURCE FIXTURES

A. General:

1. LED Light Source Fixtures to be of the type called for on the light fixture schedule.
2. LED Light Source Fixtures to be four (4) feet or six (6) feet in length as shown on the Drawings.

B. LED Light Source Fixture Sub-Assembly:

1. Each LED Light Source Fixture to consist of one complete sub-assembly designed for field installation. Sub-assembly to consist of the following:
 - a. LED board.
 - b. Aluminum heat sink/chassis.
 - c. Mounting plate.
 - d. Power supply.
 - e. Internal ON/OFF toggle switch.
 - f. Fuse.
2. LED light source sub-assemblies will be built to UL8750 for LED Lighting Equipment and to UL1598C for Luminaire standards.
3. The LED light fixture to consume zero (0) watts in the off-state, excluding any control devices.
4. Installation instructions for all LED light source sub-assemblies to be provided by the manufacturer.

- C. LED Light Source Sub-Assembly for 1' X 4" Fixture:
1. Each fixture to consist of four (4) LED boards.
 2. Total electric power consumption for each fixture to be rated at 72 watts.
 3. Each LED board to consist of 54 LED chips with lumen outputs 38 per chip and color temperature 5000 degree K.
 4. The LED board to be securely affixed to mounting plate so that it is not affected by vibrations.
 5. The chip manufacturer to be Samsung, Seoul Semiconductor, Cree, Philips, Nichia or other approved equal high quality industrial grade manufacturer.
- D. LED Light Source Sub-Assembly for 1' X 4" Angled Fixture:
1. Each fixture to consist of four (4) LED boards.
 2. Total electric power consumption for each fixture to be rated at 72 watts.
 3. Each LED board to consist of 54 LED chips with lumen outputs 38 per chip and color temperature 5000 degree K.
 4. The LED board to be securely affixed to mounting plate so that it is not affected by vibrations.
 5. The chip manufacturer to be Samsung, Seoul Semiconductor, Cree, Philips, Nichia or other approved equal high quality industrial grade manufacturer.
- E. LED Light Source light engine and Light fixture Manufacturers:
1. Seesmart Lighting.
 2. Cooper – (Geier) Lighting.
 3. Kenall Lighting.
 4. Hubbell Lighting.
 5. Cree Lighting.
 6. Kurtzon Lighting.
 7. Acuity Brands (Lithonia Lighting).
 8. Approved Equal.
- F. LED Power Supply:
1. Power supply to be Class 2 rated for a nominal input voltage of 120 to 277VAC with a voltage range of 108 to 305 VAC and a constant output voltage of 24VDC with an input frequency of 50/60 Hz, Nominal current of 2 Ampere, Current range of 1 Ampere to 2 Ampere, Current overshoot less than 20 percent, Ripple current less than 5 percent, and output voltage range of 18 to 24 VDC.
 2. Power Supply to be securely fixed to mounting plate so that it is not affected by vibrations.
 3. Power supply to carry UL and CE labels.
 4. Power supply to be rated for temperatures ranging from minus 40 to plus 90 degrees C. The power supply to be suitable for use in dry and damp locations. The Total Harmonic Distortion (THD) to be less than 20 percent. The power supply to have a power factor greater than 95 percent. The power supply to have an audible noise rating of Class A or better.
 5. Power supply line transient harmonics to comply with EN 61003-2 and EMC immunity to comply with IED 640004-4. Surge protection to comply with combination wave test procedures per IED 610004-5 and ANSI C62.41.
 6. The electronic power supply to be Philips Advance, MeanWell, Thomas Research Product, or approved equal. The power supply to be long-life (100,000 hours) and carry a five (5) year warranty. Manufacturer to be a full line power supply manufacturer with a ten (10) year history of producing power supplies for the North American Market.

7. The power supply to conform to FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A).

G. Lumen Depreciation:

1. Lumen depreciation per IESNA LM-80 is compared to the published lumen output of the product per IESNA LM-79 testing and reporting standards.
2. Normal accumulation of particles on the optical surfaces to not be factored into the lumen depreciation.
3. A Coloring Rendering Index (CRI) of 80 to apply to all LED lamps.

H. Light Engine Wattage:

1. Light engine wattage will vary by light fixture type.
2. Light engine modules to provide nominal 4000 initial bare lumens.
3. Life/lumen maintenance to provide greater than or equal to 70 percent of the initial lumens at 50,000 hours.

2.08 RECESSED FIXTURES

- A. Recessed fixtures to be of type suitable for mounting in the type of ceiling as scheduled on the Fixture Schedule. Variations to catalog numbers indicated on the Fixture Schedule to be made by the Contractor prior to placing order for the fixtures to insure proper mounting arrangement.
- B. Fixtures installed in plenum ceilings to be approved for that application.
- C. The Contractor to furnish plaster frames for recessed fixtures in plastered rooms.

2.09 EXIT SIGN

- A. General Requirements: Comply with UL 924, be Chicago Code Approved/Wet Location, and the following:
 1. Provide as indicated on light fixture schedule included with contract drawings.
 2. Sign Colors and Lettering Size to comply with authorities having jurisdiction.
 3. Internally Lighted Sign: Light source for AC Operation to be White LED, 3.7 watts, 25 year life expectancy.
 4. Standard input voltage to be 120 Volts AC
 5. Exit Sign to be suitable for both interior and exterior locations.
 6. Housing to 20 gage stainless steel, white powder coat finish with vandal resistant lens.
 7. Mounting to be ceiling or back.
- B. Exit Signs to be self-powered, battery type, with integral automatic charger in a self-contained power pack.
 1. Battery to be sealed, maintenance-free, nickel-cadmium type, 6-volt operation, with special warranty.
 2. Charger to be fully automatic, solid-state type with sealed transfer relay.
 3. Operation to be as follows: Relay automatically energizes LED light source from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
- C. Manufacturer of Exit Sign fixtures:

1. Big Beam Emergency Systems.
2. Approved equal.

2.10 EXTERIOR LIGHTING

- A. The Contractor to furnish labor and install all material necessary to provide exterior lighting as indicated on the Drawings.
1. Fixtures to be suitable for outdoor surface and suspended mountings.
 2. Fixtures Type "A", to be a 4 foot fluorescent or LED type of similar cons appearance and finish. Lens to be clear prismatic polycarbonate with 0.187 inch thick and smooth outside.
 3. Fixtures Type "B", to be a 6 foot fluorescent or LED type of similar cons appearance and finish. Lens to be clear prismatic polycarbonate with 0.187 inch thick and smooth outside.
 4. Fixtures, Type "C", to be a 6 foot triangular shaped suitable for outdoor corner mountings. The main beam to be at 90 degrees to the lens surface.
 5. Fixtures to be of the enclosed and gasketed type suitable for wet locations.
 6. Ends and body to be one piece or to be made one piece by continuous (Heliarc) welding all seams, grinding them smooth and finishing to match the various parts.
- B. Chassis Construction:
1. Chassis to be constructed of Number 304 stainless steel.
 2. Fixture type "A" and "D" to be 48"x12"x6-1/2" and to be constructed from #18 gage steel with minimum of two (2) interior reinforcing gussets.
 3. Fixture Type "B" to be 50.81" x 9.79" x 66.77" and to be constructed from
 4. 16 gage stainless steel with a minimum of two (2) interior reinforcing gussets.
 5. Fixture Type "C" to be 50.81" x 7 3/4" x 7 3/4" and to be constructed from 18 gage steel with a minimum of two (2) interior reinforcing gussets.
 6. All seams in the chassis to be externally welded shut, ground smooth and finished to make a watertight enclosure. Welding to be continuous of the Heliarc type.

7. Strength:
 - a. Fixture chassis to be designed with sufficient rigidity and strength to protect the components inside from damage and withstand without fracture or excessive permanent distortion due to weather or moderately determined acts of vandalism.
 - b. Fixture to withstand without damage 100 MPH winds and ice loads.
 - c. Fixture to withstand without excessive or permanent distortion a two hundred pound weight suspended from one end when it is supported from one point, 6 inches in from the fixture ends on its central axis for the 4 foot fixture.
 8. Chassis to be shaped to enhance structural rigidity and to provide a seat on which the door frame and its gasket to seal.
- C. Finishes:
1. Stainless steel fixtures to have a natural satin Number 4 finish.
 2. Seam welds on all chassis to be ground smooth and finished to match surrounding metal.
- D. Diffuser (Door) Frame:
1. Frame to rigidly and totally enclose and support the perimeter of the fixture diffuser and to mate with the fixture chassis to form a weathertight seal.
 2. Frame to be constructed of minimum 12 gage angle iron. Corner to be mitered and seams fully welded and ground smooth. Frame material to be the same as chassis.
 3. Frame members and joints between members to have sufficient rigidity as a unit to prevent distortion during relamping.
 4. Frame to be fully hinged along the long axis of the fixture with a continuous hinge. Door frame to be attached to hinge at every six inches with stainless screws.
 5. Door frame to be so constructed and latched that the sealing gasket interface between the chassis and frame is compressed along its entire length.
 6. Frame to be constructed to permit removal of lens for replacement without demounting the fixture or removal of the door. Removal to be accomplished without breaking or distorting the frame.
 7. Frame to securely enclose the diffuser but to provide adequate clearance for differential thermal expansion and contraction and to permit diffuser to deform when it accepts impact.
- E. Gaskets:
1. Gasketing to be continuous on both sides and ends of the fixture between the hinged door and the upper housing (chassis) and between the diffuser and its supporting frame.
 2. Gasketing material to be close cell sponge neoprene, soft or medium density, evenly textured with high resistance to aging, heat, ultra-violet light, water, oils, weathering and setting.
 3. Gaskets to be cemented to the various components with resilient neoprene sealing compound. Compound to be compatible with the finish to which it is applied.
 4. Gasket to not exhibit any noticeable stiffening at temperatures down to 0 degree F and to be satisfactory for long life in summer and winter temperatures in Chicago.

5. Water and aqueous solutions to not cause swelling nor be absorbed by the gaskets.
6. Gasket to be self-extinguishing and flame resistant.

F. Mechanical Components:

1. Hinges for external fixture components.
 - a. Hinges to be continuous and designed to prevent accidental disconnection of connected fixture components while being hinged down and in the open position.
 - b. Hinge to be fabricated from the same material as the pieces connected thereby and to be sufficiently rigid to prevent distortion in service.
 - c. Hinges where not an integral part of connected components to be affixed to the pieces connected thereby with a continuous weld or other approved means to prevent distortion in service.
2. Hinges for internal fixture components:
 - a. Hinges for reflector and other internal fixture components to be suitable for the weight suspended and the service requirements.
 - b. Hinges to be firmly affixed to the pieces they connect and to not bend or distort in service.
 - c. Hinges to be fabricated from the same or galvanically compatible materials as the pieces connected thereby.
 - d. Hinges to be designed to prevent accidental disconnection of fixture components connected thereby while being hinged down and in the open position but to be capable of ready disconnection for removal or replacement of parts.
3. Locking Devices:
 - a. All locking devices that must be activated for maintenance or relamping to be stainless steel with positive lock-up that will not disengage due to vibration caused by the trains.
 - b. All locking devices to be of the captive design. Only stainless retainers to be used to retain the screws in place.
 - c. External locking devices to be tamper resistant screws.
 - d. Internal locking devices to be quarter turn fasteners thumb operated type.
4. Fasteners:
 - a. All threaded fasteners to be made of the same material as the piece into which they are threaded. No aluminum fasteners will be permitted.
 - b. All fasteners to have a thread sealant applied to prevent vibration from loosening same.

G. Illumination Components:

1. Lamps:

a. Fluorescent

- 1) Lamps to be 48 inches nominal length as required to completely fill the length of the fixture.
- 2) Lamps to be fluorescent type of the 800 MA high output preheat rapid start design.
- 3) Lamp color to be cool white.
- 4) Lamp bases to be recess double contact type.
- 5) All lamps to be specification 41 as manufactured by Phillips Lighting Co. or approved equal.

b. LED

- 1) LED lighting components to be nominal length as required to completely fill the length of the fixture.
- 2) LED color 5000K
- 3) All LED light sources to be manufactured by Samsung, Seoul Semiconductor, Cree, Philips, Nichia or approved equal.

2. Reflectors:

- a. Reflectors to be formed from stainless steel and to extend the full width and length of fixture.
- b. Reflector to fasten into position with 1/4 turn fasteners and to lock- up tight to prevent noise during vibration of fixture.
- c. Reflectors to be finished with high reflectivity glass white enamel, baked on after the reflector has been degreased and phosphatized. Minimum reflectivity to be eighty-seven percent.
- d. Reflector mounting to be such that the reflector can be easily removed for ballast changing by one man unaided.
- e. Reflector to be prevented from falling out of the fixture when it is unlatched. Provide safety chains, hinges or other approved means of sufficient number and so located as to prevent reflector from swinging down and causing injury.
- f. Reflector to be "V" shaped in the middle to give better lighting distribution and increase the efficiency of the fixture.

3. Diffuser:

- a. Diffuser to be fabricated from 0.187 inch thick prismatic clear polycarbonate for "H" type fixture. Additional diffuser types for remaining fixtures.
- b. Diffuser to effectively obscure the outline of the source during fixture operation and to as far as practical maintain an even surface brightness across the diffuser.
- c. Lens/diffuser to be fully enclosed and mechanically held in a completely gasketed, rigid door frame.
- d. The combination of lens/diffuser to have all edges sealed to keep out dust, dirt and moisture.
- e. Provide prismatic and clear polycarbonate lens manufactured from General Electric "Lexan" or Rohm and Haas "Tuffac".
- f. The light transmittance rating of the lens to be 0.86 inch minimum.

H. Electrical Components – Sockets (Fluorescent):

1. Sockets to be basically porcelain of the telescopic tombstone design and to be spring loaded for use with a recessed double contact HO fluorescent lamp.
2. Sockets to have screw terminals for connection of ballast lead wires. Terminal screws to be brass. No steel will be accepted.
3. Sockets to be securely mounted to the fixture with four (4) screws and to provide rigid support for the lamp.
4. Sockets to be rated 600 volt AC and 660 watts.
5. Sockets to be mounted so that telescopic spring tension, when lamped, will not produce distortion of the socket angle.
6. Socket plates to be fabricated from 16 gage stainless steel. It to be rigid and removable from the fixture.

I. Light Poles (when required):

1. Provide 4 inch diameter tubular steel luminaire support poles as shown on the Drawings. Poles to be of sufficient length to provide a nominal height of ten feet above the platform when resting on the platform support beams.
2. Poles to be designed for a maximum wind loading of 100 MPH, with the specified fixture.
3. Provide plates, supports, and handholes as shown on the Drawings.
4. All welds to be ground smooth and the poles to be given a shop coat of primer, and made ready for field painting as indicated in Specification 261000. "Basic Electrical Materials and Methods"

2.11 LAMPS

A. Fluorescent

1. Fluorescent lamps to be cool white to match the ballast unless otherwise indicated. Fluorescent lamps to be F32/T8/TL741 for electrical room, janitor's room and kiosk and F48/T8/HO/TL841 for all other applications.
2. Acceptable manufacturers to be General Electric, Sylvania, North American Phillips, or approved equal.

B. LED

1. LED color temperature 5000K.
2. Acceptable manufacturers to be Seesmart, Cooper Lighting, Kenall Lighting or approved equal.

2.12 LIGHT CONTROL

- A. Provide local switching for all employee, maintenance, equipment and storage spaces. All other individual circuit switching to be done at the panelboard.

2.13 ENVIRONMENTAL CONTROL

- A. Gaskets:
1. Gasketing to be applied continuous at specified interfaces.
 2. Gasket to be applied around diffuser and its supporting frame and around diffuser door frame and fixture body.
 3. Gasketing material to be closed cell neoprene, soft or medium density, even textured with high resistance to aging, heat, ultra-violet light, water, oils, weathering and setting.
 4. Gaskets to be cemented to the various components with resilient neoprene sealing compound. Compound to be compatible with the finish to which it is applied.
 5. Gasket to not exhibit any noticeable stiffening at temperatures down to 0 degrees F and to be satisfactory for long life in summer and winter temperatures in Chicago.
 6. Water and aqueous solutions to not cause swelling nor be absorbed by the gaskets.
- B. Conduit entries to be field drilled by the Contractor in the top or end plate of each fixture as required.

2.14 TESTS FOR FIXTURES

- A. Fixtures to be submitted in accordance with the requirements of Related Documents. The Authority will determine if the submittal is in compliance with the requirements of this specification prior to the final acceptance of the fixture. Contractor to submit one sample of each type of light fixture for approval of the Authority.
- B. Overall efficiency (fixture output in lumens/lamp lumens) to not be less than 50 percent for "A" and "D" fixtures, and 45 percent for type "C" fixtures.
- C. A minimum of 85 percent of the fixture lumens output to fall within 60 degrees to be from nadir for type "A", "B" and "D" fixtures and 90 percent of the fixtures lumens output to fall within 120 degrees from nadir for type "C" fixture.
- D. The main beam to be at 90 degrees to the lens surface.

2.15 FACTORY INSPECTION

- A. Contractor to require the manufacturer's production facility available to the Authority for inspection before and after manufacture of the fixtures called for under this contract.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
- B. There aluminum contacts concrete or dissimilar metal, separate contact surfaces with gasket, non-absorptive tape or bituminous coating to prevent corrosion. Use stainless steel fasteners. Aluminum fixtures to not be installed in contact with wood, or in any other situation where permanent moisture can exist.

- C. Fixtures to be mounted plumb, level and in straight lines. Group-mounted fluorescent/LED fixtures to appear as one unit.
- D. In areas where industrial type fixtures are to be installed such as Equipment Rooms, fixtures which are near obstructions near the ceiling such as ducts, large pipes, groups of pipes, etc., to be suspended so that the bottom of the fixture is not higher than the bottom of the duct, etc. Outlets not to be located until the location of these obstructions are determined. Outlets to not be covered; conduits to be installed exposed. Fixture to have standard wireguard.
- E. Lighting poles, when required, to be installed as shown on the Drawings. The installation to result in vertically plumb poles, and to provide for a minimum of fixture vibration.
- F. The Contractor to supply all required lamps/LED lighting components, clean lamps, diffusers, globes, reflectors and exposed-to-view surfaces of fixtures after aiming and adjusting have been approved.
- G. The Contractor to provide gasketing and other means to make the fixture mounting and conduit entry watertight.

3.02 FIXTURE SUPPORTS

- A. It is the Contractor's responsibility to provide and install all hardware to support all lighting fixtures adequately.
- B. Each lighting fixture to be rigidly supported from the building construction and to include suspension hangers devices and extra steel work for fixture support where required.
- C. The Contractor to coordinate with the work of other trades to determine modifications required to make fixtures suitable for the location as installed, and verify the construction prior to fixture fabrication.
- D. Recessed fixtures to be provided with the proper plaster frame or suitable adapter to receive the finished ceiling construction.
- E. Where suspended ceilings with steel channels occur, outlets and fixtures to be supported on members resting on the channel framework. In no case to fixtures be supported from plasterboard, plaster or acoustic material. No chains to be used for hanging fixtures.
- F. The Contractor not to use the lighting fixtures as raceways. Any connections to adjacent fixtures or continuous rows of fixtures to be through the conduit system. Unistrut or other metal raceways are not acceptable for wiring connections.
- G. Suspended fixtures to be hung on ball and cushion swivel flexible fixture hangers, as manufactured by Appleton Electric Company or approved equal, and furnished by the Contractor and to be adjusted as necessary during installation to insure that all fixtures in the same room or area are a uniform height detailed or noted on the Drawings.

3.03 MOTION SENSOR SWITCH INSTALLATION

- A. Provide conduit, wiring and boxes for installation of motion sensor switches to control lighting in the space. Install according to manufacturer's directions. Provide for manual over-ride. Install on the line or side of switches.
- B. Program and adjust motion sensor switches for optimum operation at each space and Installation.

3.04 TESTING INSTALLATIONS

- A. The Contractor to furnish necessary personnel and equipment and perform tests and adjustments in the presence of the Authority. Schedule adjustment of exterior installations to occur during hours of darkness.
- B. The Contractor to test lighting circuits for continuity and operation.
- C. The Contractor to test fixtures and mounting poles for continuity of grounding system.
- D. The Contractor to aim and adjust fixtures to provide distribution patterns approximately as shown and as approved.
- E. Once tested and accepted by the Authority, Contractor to provide a minimum of 20 percent spare lamps or LED light sources (rounded to nearest whole number) for each type of light source provided.

3.05 CIRCUITING

- A. The Contractor to provide complete branch circuiting between panels and lighting fixtures. Circuits to be as shown on the panel schedules.
- B. Final connection to light fixture to be with heat resistant wire of the following type:
 - 1. Fluorescent 120 volt, Number 14 AWG Type THWN insulation.
 - 2. Incandescent 120 volt, Number 14 AWG Type SF-2 insulation.
 - 3. LED lighting 120 volt, Number 14 AWG Type THWN insulation

END OF SECTION 26 50 10

SECTION 26 55 60
LIGHT EMITTING DIODE (LED) SIGN BOX FOR INFORMATIONAL SIGNAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

A. Section Includes

1. The Contractor to furnish, install and connect all illuminated signs and sign boxes as shown on the Drawings and indicated on the Schedules.
2. This section includes providing all materials, equipment and labor to fabricate, provide, install and connect the following types of signs:
 - a. Light Emitting Diode (LED) Illuminated informational signs and sign box cabinets for installation at the interior and exterior of CTA Rapid Transit Stations and other locations for customer information.
 - b. Include all required accessories, attachment and attachment devices necessary for attachment of the sign boxes and make all required electrical and other connections. Provide all required conduit, wiring, switches, disconnects, other electrical devices and electrical work required for functional and proper operation of the signs.
 - c. Provide and install illuminated informational signs, sign boxes, mounting accessories, attachment devices, and associated hardware for installation in accordance with requirements of the contract documents. These signs are used at various locations at the transit stations and other locations. The number of signs, size of each sign, type of sign, graphics, location for each sign and type of installation for the signs are indicated on the drawings and/or schedules. The Authority will supply original artwork for the sign faces in Adobe Illustrator electronic format. Remove any existing signs as applicable, specified or directed. Provide new and/or additional framing and supports as indicated on the drawings or as required for proper installation of the signs. Provide mounting accessories, attachment devices and associated hardware as specified, as shown on the drawings, or as otherwise required.
 - d. Verify actual sign locations and installation conditions in the field. Verify access to electrical sources and requirements to provide power to the illuminated signs and requirements for making electrical connections.
 - e. See drawings, schedules, and/or verify in the field for standard and special installation details for each sign; type of installation, anchorage, mounting heights, mounting conditions, additional framing and support required, installation accessories required, spacing of anchors and other details.
 - f. Refer to Specification Section 26 50 10 for methods of construction and installation that apply to interior and exterior lighting systems at rapid transit stations and other locations as they apply to illuminated sign assemblies.
4. Sign box assemblies to bear the Underwriter's Laboratories labels and to be purchased, wired and installed in accordance with regulations applicable to the Chicago Electrical Code.
5. Sign box manufacturers and catalog numbers provided herein specify the standard of quality and appearance required and to represent the basic sign box

of that type. Substitutions to the listed acceptable manufacturers will not be accepted until the Contractor has substitution for review and approval.

6. Signs, graphics, sign boxes, bulbs, mounting brackets, mounting hardware, electrical wiring, conduit, switches, disconnects and all other accessories for all sign boxes to be supplied by the Contractor. The Contractor to install the light box assemblies and make all required electrical connections for a functional and proper working system.
7. LED light sources, drivers and electrical accessories and supplies to be supplied by the approved manufacturer.
8. Reference Standards: The work is subject to applicable portions of the following standards:
 - a. "Electric Signs", Standards for Safety, UL Publication 48, Underwriters Laboratories Inc.

1.03 RELATED WORK

- A. LIGHT EMITTING DIODE (LED) SIGN BOX FOR INFORMATION SIGNAGE specified to be furnished and installed herein have related work in various other sections, including, but limited to:
 1. Division 10, Graphics Sections apply to this section.
 2. Division 26, Electrical Sections apply to this section.

1.04 SUBMITTALS

- A. General: Contractor to submit the following in, for the Authority review and approval:
- B. Product data to include manufacturer's product data, technical data, complete technical specifications, construction details and installation instructions relative to materials, dimensions of individual components, profiles, finishes, and installation details for each type of sign and sign box required. Indicate proposed materials and fabrication of sign assemblies.
- C. Submit shop Drawings to the Authority for review and approval prior to fabrication of illuminated signs. Provide shop drawings for fabrication of each type of sign and sign box. Provide shop drawings for each installation condition for each type of sign. Include typical details of materials, fabrication, and graphics. Include plans, elevations, and large-scale sections of sign face, sign frame or housing, typical members and other components. Show anchors, reinforcement, accessories, layout, and installation details. Show electrical components and required connections.
 1. Provide complete sign schedule for illuminated sign assemblies, including the following information for each sign:
 - a. CTA sign identifier.
 - b. Quantity.
 - c. Mounting type.
 - d. Dimensions
 - e. Visual opening
 - f. Blank size
 - g. Colors
 - h. Message
 - i. Location(s)
 - j. Cross references to the following detail drawings:
 - 1) Graphic Detail

- 2) Elevation Detail
 - 3) Section Detail
 - 4) Mounting Detail
- k. CTA Design Number
- l. Remarks
- m. Mounting Height
- n. Signage Plan Drawing Reference
2. Provide drawings for graphics for each sign, including dimensions of sign face, sign blank, visual opening, sign message and sign colors.
 3. Provide separate elevation details, section details, and mounting details for each sign.
 4. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed.
- D. Provide wiring diagrams from the manufacturer for each type of illuminated sign unit. Provide specifications for each type of LED, driver and other electrical components used.
- E. Submit samples of each sign material or component used showing finishes, colors, surface textures and qualities of manufacturer.
1. Submit full-size sample units, if requested by the Authority. Acceptable units may be installed as part of work.
 2. Color samples, 3 each of all paint colors, on specified materials for illuminated signs and station identifier sign. Color samples will be retained by the Authority.
 3. Provide a sample panel of each sign type, not less than 8-1/2 inches by 11 inches. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.
 4. As required by the Authority, provide full size samples for approval of any accessories proposed for the installation and attachment of the signs, including hangers, straps, frames and other attachment accessories.
 5. The Authority is not responsible for any samples that are not received.
 6. All samples to be sent to:

Chicago Transit Authority, Signage & Wayfinding Section.
567 West Lake Street, 8th Floor, Chicago, IL 60661,
Attn: Victor A. Ramirez
- F. Submit a material list of all mounting accessories including reinforcing, angles, channels, hangers, straps, frames, etc. Indicate all materials, sizes, thicknesses, shapes, etc.
- G. Submit a material list of all attachment devices including anchors, screws, washers, grommets, and rivets indicating material, size, and spacings. Indicate weld types, sizes and locations.
- H. Submit a material list of all electrical components.
- I. Approval of the shop drawings by the Authority is required prior to issuance of digital artwork file.

1.05 STANDARDS

- A. The work is subject to applicable portions of the following standards:
 - 1. "Electric Signs", Standards for Safety, UL Publication 48, Underwriters Laboratories Inc.

1.06 QUALITY ASSURANCE

- A. Submit adequate evidence, prior to awarding of the contract, that the items to be furnished will conform completely to the contract documents.
- B. Fabricator and Installer to be experienced specialty firms having a minimum of 5 years successful experience and regularly engaged in fabricating and installing work of same types required for this project. Employ only skilled tradesmen who are thoroughly experienced with the materials and equipment to be used in the work.
- C. Sign/Support Performance to provide outdoor sign assemblies designed, tested, and installed to withstand positive and negative wind loading of 40 psf (1.9 kPa) wind pressure loading, in accordance with Chicago Building Code. Signs to be moisture proof.
- D. Provide lighting sign boxes and electrical components for illuminated signs that are labeled and listed by UL and comply with applicable NEMA standards.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Signs to be adequately protected during delivery of the work to prevent damage by scratches, stains, discoloration, or other causes. The signs to be crated. Damage to any surface during fabrication, handling, shipment, storage, and installation to be remedied by the Contractor at Contractor's own expense.

1.08 PROJECT CONDITIONS

- A. Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings.
- B. For each location, verify in the field prior to installation the number, location, heights, and installation conditions for each type of sign. Discrepancies to be reported to the designated representative from the Authority for review and determination. Similarly, report any conflicts to the proper installation of the sign at the location designated. Adjustments in the field will have to be made according to actual field conditions. The Authority's field representative may also dictate adjustments based on actual field conditions at the time of installation.
- C. Contractor to coordinate fabrication and delivery schedule of signs with installation schedule of signs, to avoid delays. Contractor to also coordinate supply of mounting and installation accessories and attachment devices required for installing the signs at each location, according to the installation schedule.
- D. Contractor to coordinate and provide all electrical work required including conduit, wiring, adequate electrical supply and connections prior to delivery and installation of the sign assemblies, to avoid delays and according to the installation schedule.
- E. The Authority will provide art work for signs in Adobe Illustrator electronic format.

1.09 WARRANTY

- A. Submit a written warranty for the materials and work of this section. All materials and work, including installation, to be in exact accordance with these specifications and is to

be guaranteed for the minimum period of two (2) years from date of acceptance by the Authority, unless noted otherwise. Upon notification of defects or malfunction of the sign within the warranty period, the Contractor to make necessary repairs or replacement at the convenience of the Authority and at no cost to the Contract.

- B. Submit a five (5) year written warranty, signed by the Fabricator, Contractor and Installer, warranting that the signage finishes will not develop excessive fading or excessive non-uniformity of color or shade; and will not chip, crack, peel, pit, or be subject to pin holes, scratching, or otherwise fail as a result of defective materials or workmanship. Upon notification of such details, within the warranty period, make necessary repairs or replacement at the convenience of the Authority and at no cost to the Authority. Warranty to cover the finishes of all components of the sign assembly: sign face, sign box, sign frame, and all accessories.
1. "Excessive Fading": A change in appearance which is perceptible and objectionable as determined by the Authority when visually compared with the original color range standards.
 2. "Excessive Non-Uniformity": Non-uniform fading during the period of the guarantee to the extent that adjacent panels have a color difference greater than the original acceptable range of color.
 3. "Will Not Pit or Otherwise Corrode": No pitting or other type of corrosion, discernible from a distance of 10', resulting from the natural elements in the atmosphere at the project sites.
- C. Additional Warranty Requirements for LED Sign boxes:
1. The LED light source, driver and other LED components (RoHS compliant) of LED sign boxes to be additionally warranted by the manufacturer for a period of five (5) years against defects in materials and workmanship that result in a signbox lumen depreciation of 30 percent or greater. Upon notification of such defects or malfunction within the warranty period, the Contractor to make necessary repairs or replacement of the fixture at the convenience of the Authority and at no cost to the Contract.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The Contractor to furnish and install all sign boxes in strict accordance with the Lighting Sign box Schedule and Lighting Sign box Details as described hereunder or on the Drawings. Sign boxes to be complete with all necessary accessories and related work including LEDs, drivers, cable raceways, prismatic style lens, frames, support, wiring, conduit and all connections. The Contractor to provide supports from framework where no finished ceiling occurs.
- B. The Contractor to provide auxiliary supports for mounting sign boxes in areas without ceilings (i.e. exposed beams and joists) as may be required for proper installation of sign boxes. Such supports to span a minimum of two joists for each individual sign box, and to be securely and suitable anchored to same. Sign boxes to not be supported from underside of roof deck or built tees except as specifically noted otherwise on the Drawings, the detail to be followed.
- C. Sign box to bear the Underwriter's Laboratories labels and to be purchased, wired and installed in accordance with regulations applicable to the City of Chicago Electrical Code.
- D. Before, during and after installation of the sign box assemblies, The Contractor to provide adequate protection for the sign boxes and at completion of the work they to be clean and free of foreign material. Replace all burned out or defective LEDs, drivers, etc., until such time as the Authority takes complete occupancy of the facility.
- E. All material furnished under this contract to be new and of the best quality practicable for the application.
- F. All sign boxes to be constructed to be sturdy and rigid. Sign boxes located in public areas at a mounting height of ten feet or less to be designed to be vandal resistant.
- G. Sign boxes and all components to be constructed, assembled, fastened and connected for maximum endurance to the vibration present on the CTA platforms.
- H. Sign boxes to have simple lines and a clean uncluttered appearance. There to be a minimum of exposed hardware.
- I. The sign box to be so constructed, hinged and latched that driver replacement and LED light source component replacement can be performed safely by one individual from a centrally located ladder, without requiring relocation of the ladder or removal of the fixture.
- J. Sign boxes to be designed and tested to maintain the temperature of all interior components (LEDs, drivers, gaskets, diffusers, etc.) below their respective manufacturers recommended normal operating temperature, for any predictable electrical or environmental operating condition.
- K. Each sign box to be assembled from material components in a careful manner by persons experienced in their line of work. Forming, assembly and subassembly to be accomplished such that all parts come together in the sign box to form a complete, well fitted integrated assembly.
- L. Conduit and wire entries to the sign box to be field drilled by the Contractor in the top or end plate of the chassis. Entry to be flush with the top of the sign box.

- M. The entire lens area of the sign box (exclusive of door frame members) to be illuminated. There to be no black or unlit areas including those areas where the driver or LED holders are located.
- N. Sign boxes and luminaires must be manufactured in the United States and adhere to the ARRA Buy American Compliance Act.
- O. Illumination levels on the sign surface to be in the 200 lux range (20 FOOTCANDLES) or greater to comply with the Authority's Illumination requirements as well as the current Americans With Disabilities Act Guidelines for Illumination (US DOJ ADAAG – Section A4.30.8).

2.02 POWER DISCONNECT FOR SIGN BOXES

- A. Provide a power disconnect in the conductors supplying the sign box or LED engine.
- B. Disconnect to be self-aligning (polarized) snap in type and to contain three wires, one each for the hot, neutral and equipment ground conductor.
- C. Disconnect to facilitate easy removal of the LED engine for maintenance and to be prewired by the sign box manufacturer.
- D. Male side of disconnect to be connected to the LED engine power lead-in wires so that exposed contacts are dead in the disconnected position.
- E. Disconnect to be UL listed. The dielectric strength of the connector to be 1500 volt minimum.

2.03 WIRING FOR SIGN BOXES

- A. Wire inside sign boxes to be copper conductor of amp capacity required plus twenty- five percent (25%) for continuous load.
- B. Insulation to be rated for 1000 volt AC and to be rated for operation at 200 degrees in dry locations.
- C. Provide type FF glass braid insulation.
- D. All connections inside the sign box to be made with wire nuts rated for a minimum of 90 degrees C.

2.04 ON/OFF TOGGLE SWITCH FOR SIGN BOXES

- A. Provide a power toggle switch in the conductors supplying the sign box power supply.
- B. Toggle switch to contain three wires, one each for the hot, neutral and equipment ground conductor.
- C. Toggle Switch to facilitate easy removal of the power supply for maintenance and to be prewired by the sign box manufacturer.
- D. Toggle switch to be UL recognized and CSA approved. The dielectric strength of the connector to be 1000 volt minimum.
- E. Toggle Switch to be installed next to power supply.

2.05 WEATHERPROOF GASKETS

- A. Gaskets to be continuous on both sides and ends of the sign box between the hinged door and the upper housing (chassis) and between the diffuser and its supporting frame.
- B. Gasket material to be close cell sponge neoprene, soft or medium density, evenly textured with high resistance to aging, heat, ultra-violet light, water, oils, weathering and setting.
- C. Gaskets to be cemented to the various components with resilient neoprene sealing compound. Compound to be compatible with the finish to which it is applied.
- D. Gaskets to not exhibit any noticeable stiffening at temperatures down to 0 degrees F and to be satisfactory for long life in summer and winter temperatures in Chicago.
- E. Water and aqueous solutions to not cause swelling nor be absorbed by the gaskets.
- F. Gaskets to be self-extinguishing and flame resistant.

2.06 MECHANICAL COMPONENTS

- A. Hinges for external sign box components:
 - 1. Hinges to be continuous and designed to prevent accidental disconnection of connected sign box components while being hinged down and in the open position.
 - 2. Hinge to be fabricated from the same material as the pieces connected thereby and to be sufficiently rigid to prevent distortion in service.
 - 3. Hinges where not an integral part of connected components to be affixed to the pieces connected thereby with a continuous weld or other approved means to prevent distortion in service.
- B. Hinges for internal sign box components:
 - 1. Hinges for reflector and other internal sign box components to be suitable for the weight suspended and the service requirements.
 - 2. Hinges to be firmly affixed to the pieces they connect and to not bend or distort in service.
 - 3. Hinges to be fabricated from the same or galvanically compatible materials as the pieces connected thereby.
 - 4. Hinges to be designed to prevent accidental disconnection of sign box components connected thereby while being hinged down and in the open position but to be capable of ready disconnection for removal or replacement of parts.

C. Locking Devices:

1. All locking devices that must be activated for maintenance or re-lamping to be stainless steel with positive lock-up that will not disengage due to vibration caused by the trains.
2. All locking devices to be of the captive design. Only stainless retainers to be used to retain the screws in place.
3. External locking devices to be tamper resistant screws.
4. Internal locking devices to be quarter turn fasteners thumb operated type.

D. Fasteners:

1. All threaded fasteners to be made of the same material as the piece into which they are threaded. No aluminum fasteners will be permitted.
2. All fasteners to have a thread sealant applied to prevent vibration from loosening same.

2.07 ILLUMINATION COMPONENTS

A. Lamps:

1. LED
 - a. LED lighting components to be nominal length as required to completely fill the length of the sign box.
 - b. LED color 5000K
 - c. All LED light sources to be manufactured by Samsung, Seoul Semiconductor, Cree, Philips, Nichia or approved equal.

B. Reflectors:

1. Reflectors are to be formed from stainless steel and to extend the full width and length of sign box.
2. Reflector is to fasten into position with 1/4 turn fasteners and to lock-up tight to prevent noise during vibration of sign box.
3. Reflectors to be finished with high reflectivity glass white enamel, baked on after the reflector has been degreased and phosphatized. Minimum reflectivity to be eighty-seven percent (87%).
4. Reflector mounting to be such that the reflector can be easily removed for driver changing by one man unaided.
5. Reflector to be prevented from falling out of the sign box when it is unlatched. Provide safety chains, hinges or other approved means of sufficient number and so located as to prevent reflector from swinging down and causing injury.
6. Reflector to be "V" shaped in the middle to give better lighting distribution and increase the efficiency of the sign box.

C. Diffuser:

1. Diffuser to be fabricated from 0.187 inch thick prismatic clear polycarbonate for "H" type sign box. Additional diffuser types for remaining sign boxes.
2. Diffuser to effectively obscure the outline of the source during sign box operation and to as far as practical maintain an even surface brightness across the diffuser.
3. Lens/diffuser to be fully enclosed and mechanically held in a completely gasketed, rigid door frame.
4. The combination of lens/diffuser to have all edges sealed to keep out dust, dirt and moisture.

5. Provide prismatic and clear polycarbonate lens manufactured from General Electric "Lexan" or Rohm and Haas "Tuffac".
6. The light transmittance rating of the lens to be 0.86 inch minimum.

2.08 LIGHT CONTROL

- A. Provide local switching for all employee, maintenance, equipment and storage spaces. All other individual circuit switching to be done at the panelboard.

2.09 ENVIRONMENTAL CONTROL

A. Gaskets:

1. Gasketing is to be applied continuous at specified interfaces.
2. Gasket to be applied around diffuser and its supporting frame and around diffuser door frame and sign box body.
3. Gasketing material is to be closed cell neoprene, soft or medium density, even textured with high resistance to aging, heat, ultra-violet light, water, oils, weathering and setting.
4. Gaskets are to be cemented to the various components with resilient neoprene sealing compound. Compound to be compatible with the finish to which it is applied.
5. Gasket is to not exhibit any noticeable stiffening at temperatures down to 0 degrees F and to be satisfactory for long life in summer and winter temperatures in Chicago.
6. Water and aqueous solutions to not cause swelling nor be absorbed by the gaskets.

- B. Conduit entries are to be field drilled by the Contractor in the top or end plate of each sign box as required.

2.10 SIGNFACE MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Acceptable Manufacturers of Illuminated Informational Signs:
 - a. Western Remac, 1740 International Pkwy., Woodridge, Il. 60517 (630) 972-7770.
 - b. Doyle Signs, Inc., 232 Interstate Rd., Addison, Il. 60101 (630) 543-9490.
 - c. Pannier Graphics, 345 Oak Rd., Gibsonia, Pa. 15044 (800) 544-8428.
 - d. or approved equal.

2.11 MATERIALS

- A. Informational Sign boxes: Enclosure to be stainless steel, 20 ga. Number 4 finish.
- B. Sign faces: Plastic for the sign faces of Illuminated Informational Signs to be graphic-embedded Fiberglass Reinforced Plastic (FRP), translucent, 0.180 inches thick minimum and 0.250 inches maximum. Follow CTA Specification 616 for Embedded Fiberglass Signs. Contact the CTA Signage and Wayfinding Department for more information.
- C. Silk Screens: Photographic screen. Hand cut screens or digital output will not be allowed.

2.12 MATERIALS – PLASTIC

- A. All plastic to be UV stabilized. Plastic to be manufactured of a flame retardant resin that has been tested to comply with U.L. flammability classification 94V-0. Manufacturer to supply certification of conformance plus certification of random flame test sampling during production runs as directed by the Authority.
- B. All plastic to be manufactured of non-yellowing, clear resins.
- C. Manufacturer of plastic to certify that all plastic meets or exceeds the following test standards. If requested, the manufacturer to provide the results of these tests to the Authority:
 - 1. MIL Spec P7788A surface endurance and scratch resistance, thermal shock, humidity and impact.
 - 2. OSET Lab, Inc. Emmaqua accelerated weathering for a minimum exposure of one million Langleys without color fade.
 - 3. Federal Test Method Standard 141, Method 6152; "Accelerated Weathering".
 - 4. United States Postal Service: Acidity, cleaning compounds and fluids.
 - a. Two plastic sheets to be immersed in a 0.1 M HCL solution for 30 minutes.
 - b. Two plastic sheets to be immersed in a 0.1 M MH3 solution for 30 minutes.
 - c. Plastic to not be appreciably changed as a result of these tests.
- D. Plastic for the sign faces of Illuminated Informational Signs to be graphic-embedded Fiberglass Reinforced Plastic (FRP), translucent, 0.180 inches thick minimum and 0.250 inches maximum. Substitutions will not be permitted.
- E. Fiberglass Reinforced Plastic (FRP) to be non-yellowing, UV stabilized, acrylic-modified polyester resin reinforced with high solubility, chopped strand fiberglass mat so that the index of refraction ensures total clarity of all color, copy and graphics. Glass fibers should not be readily discernable on the sign face and signs to have a glass content no less than 28% of the total sign weight.
- F. Fiberglass Reinforced Plastic (FRP) to consist of only flame retardant resin that has been tested to comply with UL flammability classification 94V-0. Manufacturer to supply certification of conformance plus certification of random flame test sampling during production runs as directed by the Authority.
- G. Down light acrylic lens to be clear prismatic material with ¼ inches clear lexan non-glare protective cover, and to be UV stabilized on both sides.

2.13 GRAPHICS

- A. All copy and graphics to be permanently embedded in the plastic. The resulting signs to have all graphic elements inseparable from the plastic in which they are embedded. Artwork to become permanent part of plastic sign so it will not delaminate. Laminated products will not be accepted. Lettering for all signs to be Helvetica Bold, upper and lower case, to be electronically reproduced.
- B. Legends to include letters, numbers, arrows, symbols, borders and other applications shown for sign panels.
- C. After approval of Shop Drawings, the Authority will supply final artwork in Adobe Illustrator format.

2.14 PLASTIC FOR ILLUMINATED STATION IDENTIFIER SIGNS (IF APPLICABLE)

- A. Plastic for letters and logo for Station Identifier Signs to be formed of all natural Cellulose Acetate Butyrate (CAB).
- B. Colors for Identifier Sign letters, logo, and background to be the Authority's standard colors.
- C. Plastic Identifier Sign to have studs or metal threaded posts secured on rear of the letters and logo for attachment of the plastic sign. Length, spacing, and locations of studs as required by manufacturer for installation and attachment. Show studs on shop drawings submitted to the Authority for review and approval.
- D. Plastic as specified for Illuminated Station Identifier Signs to be as manufactured by the following:
 - 1. Gemini, Inc., Cannon Falls, MN.
 - 2. Approved Equal.

2.15 MOUNTING ACCESSORIES

- A. For reinforcing, brackets, angles, channels, support posts, steel tube:
 - 1. Steel plate, bent plates, clip angles, shapes, channels, angles, and bars: ASTM A36/A36M, hot dip galvanized G90 (ASTM B 633 Type GS).
 - 2. Cold-rolled steel sheet: ASTM A 653/A 653M, hot dip galvanized G90, commercial quality.
 - 3. Steel Tubing: Cold-Formed Steel Tubing, ASTM A 500 or Hot-Formed Steel Tubing, ASTM A 501, with hot-dip galvanized coating per ASTM A 53.
 - 4. Steel Pipe: ASTM A 53, galvanized, standard weight and extra heavy.
 - 5. Aluminum plate, pipe: ASTM B 221, Alloy 6063-T6.

2.16 ATTACHMENT DEVICES

- A. Use concealed fasteners where possible. Fasteners exposed to view to be of tamper-resistant and anti-vibration design. Fasteners to be of stainless steel unless approved otherwise. See drawings for type, size, spacings, locations for each application. Typically, fasteners to be flat head machine screws. Use fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- B. Use non-ferrous metal, stainless steel, or hot-dipped galvanized anchors and inserts for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, expansion shields, as required, to be set into concrete or masonry work after drilling.
- C. Continuous hinges to be National Lock Co. 56-472, Type 2, or approved equal, stainless steel.
- D. Flexible Sign Hangers: Similar to flexible sign box hangers, cushion type, enclosed and gasketed, eight degree swing in all directions, cushions 40 lbs., supports 250 pounds, $\frac{3}{4}$ inch size, as manufactured by Appleton Electric Company or approved equal. Provide 2 $\frac{1}{2}$ inch diameter galvanized pipe to cover pipe hanger where shown on the drawings.
- E. Threaded Pipe Hangers: 1 inch in diameter, galvanized with nut and washer (to be tack welded to frame).

- F. Provide brackets, collars, clips, and all other accessories required for installation of signs as approved compatible with the sign and various substrates and as submitted and approved. Fabricate brackets and fittings for bracket-mounted signs from steel to suit sign panel construction and mounting conditions indicated. All metal accessories to be stainless steel or hot-dipped galvanized and factory painted to match the sign frames.
- G. Welding Rods and Bare Electrodes to be according to AWS specifications for the metal alloy to be welded.

2.17 ACCESSORIES

- A. Provide continuous 0.05 inch rubber gasket at flanges at all locations where sign face assembly meets sign body or/and as shown on Drawings or required for weather-tight installation.

2.18 FINISHES

- A. For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Authority from the manufacturer's standards.

2.19 PAINT

- A. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.
- B. Galvanizing Repair Paint: High zinc dust content paint for touching up galvanized surfaces, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.
- C. Paint over galvanized metal:
 - 1. First Coat: Primer over galvanized metal:
 - a. Devco: 8502/8520 Mirrolac.
 - b. Fuller: 621-05 Blox-Rust Latex Metal Primer.
 - c. Glidden: 5205 Glid-Guard.
 - d. Moore: Iron Clad Galvanized Metal Latex Primer 155.
 - e. PPG: 90-709 Industrial Enamel.
 - f. P & L: Z/F 1003 Supreme Latex Metal Primer.
 - g. S-W: Galvite Paint B50W3.
 - 2. Second and Third Coats: Gloss alkyd enamel:
 - a. Devco: 70XX Mirrolac Alkyd-Urethane Gloss Enamel.
 - b. Fuller: 312-XX EPA Compliant Heavy Duty Enamel.
 - c. Glidden: 4550 Series Glid-Guard Alkyd Industrial Enamel.
 - d. Moore: Impervo Enamel 133.
 - e. PPG: 6-282 Speed Hide Gloss-Oil Enamel.
 - f. P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
 - g. S-W: Industrial Enamel B-54 Series.
 - 3. Color to be CTA White or other station color as selected and approved by Authority.

2.20 SIGNBOX FABRICATION

A. General:

1. Enlargement or reduction of sign face art is to be done electronically. Original artwork will be provided by the Authority in EPS or Adobe Illustrator format.
2. Fabricate exposed surfaces uniformly flat and smooth, without distortion, pitting, or other blemishes. Form exposed metal edges to a smooth radius. Grind exposed welds and rough areas to make flush with adjacent smooth surfaces. Provide all sign bodies with tamperproof construction.
3. Sign components to be designed for easy maintenance and replacement.
4. Sign production to not begin until shop drawings have been approved by the Authority.
5. Punch, drill, and tap finished members as required for connection to adjoining work.
6. Provide outdoor sign assemblies designed, tested, and installed to withstand positive and negative wind loading of 40 psf (1.9 kPa) wind pressure loading, in accordance with Chicago Building Code.
7. Provide a protective covering to the front of the signs to avoid damage during shipment and installation.
8. Before delivery to the site, each sign to be tagged or labeled with the identifying number and installation location as shown in the appendix. Labeling to be on the back of the sign. Any sign scratched, chipped, stained, or otherwise damaged during fabrication, handling, shipment, storage, and installation to be replaced at Contractor's expense.

B. LED SIGNBOX INTERNAL CONFIGURATION

1. Closure to provide sufficient interior space to enclose the means of illumination, its control, and test equipment.
2. Enclosure to be gasketed, weatherproof, and bug-tight. Illuminated signs to be UL listed for exterior wet locations.
3. Message compartments in the sign to be light-tight from all directions, so as to prevent seepage of light between compartments, except the message face. The interior compartments to be white.
4. Illuminate units in the manner indicated using LEDs. Make provisions for servicing and for concealed connection to the building system.
5. Access to signs for maintenance to be through a continuously hinged message face door frame held in place by external fasteners. Each hinged door to have a means of supporting the door in the open position to facilitate maintenance.
6. Electrical Service: Provide to accommodate 120/208 volt, 3 phase, 4 wire, and 120 volt, single phase, as scheduled on drawings. Where 3 phase signs occur, arrange LEDs and drivers to evenly distribute the load over all phases.
7. Power Distribution: Provide all internal wiring for drivers and LEDs. Connect to load side of disconnect switch.
8. Voltage Regulation: Provide adequate space within sign enclosure to accommodate transformers for voltage regulation should excessive voltage drop occur.
9. LEDs connected to the drivers to remain operating when supply voltage varies plus or minus 10 percent from normal.
10. Make provisions for concealed connection to the building system. Coordinate the electrical characteristics of signs with those of the power supply provided.
11. Furnish electrical components incorporated in sign construction approved and listed by the Underwriters Laboratories, Inc., and which conform to the Chicago Building Code and the National Electrical Code. The maximum temperature limit of the driver to not exceed manufacturer instructions. Install driver below LED in separate thermally isolated compartment. Provide heat sinking or fan cooling if required. Manufacturers to be Advance, General Electric, Jefferson, or Universal.

Size drivers properly and having capacity to operate the number and type of LEDs under continuous outside duty and each drivers clearly marked or labeled to shown the following:

- a. Manufacturer's name and trademark.
 - b. Catalog number.
 - c. Input voltage and frequency.
 - d. Current rating.
 - e. Open-circuit voltage.
 - f. Number of LEDs to be controlled.
 - g. Nominal current per LED.
 - h. Type of LEDs and power factor.
 - i. Wiring diagram to show correct connections for the various loads.
12. Provide all internal wiring of insulated, stranded copper, appliance wire, not lighter than Number 12 AWG and thermoplastic insulation, of such thickness and composition to provide satisfactory performance under a continuous maximum temperature of 90 degrees C. Color-code wire with white for the ground wire and secondary circuit corresponding to the color of the driver leads. Provide terminal blocks for interior power wiring connections.
 13. Provide heavy-duty, single pole, toggle switches for local compartment and LED control as indicated on drawings; also, provide a disconnect toggle switch inside the sign case of each sign, as required by the Chicago Building Code.
 14. Locate drivers, raceways and other interior components so as to prevent shadows, hot spots or dark spots on the sign faces. Distribute weight of the drivers symmetrically to provide a naturally plumb hanging of the signs. Support drivers and wiring on the bottoms of the sign cases to maintain a minimum clearance of 1/2 inch. Confine drivers lead splices to the driver junction boxes or contain in the raceways. Strip insulation on wires at connections only as required to properly make connections. Bare conductor overhang at the edge of the base to which it is connected is not allowed. Secure splices and wiring connections to LED terminals mechanically and electrically.
 15. LED lighting components to be nominal length as required to completely fill the length of the sign box. LED color 5000K.
 16. Each compartment of a multi-compartment illuminated sign to be separately controlled and wired.
 17. Illumination across the face of the sign to be uniform in brightness when the sign is turned on.

2.21 LED LIGHT SOURCE SIGNBOXES

A. General:

1. "LED Sign box" to be of the type called for on the light sign box schedule.
2. LED Light Source Sign boxes size to be determined by placement and message on the contract drawings.

B. LED Light Source Sign box Sub-Assembly:

1. Each LED Light Source Sign box to consist of one complete sub-assembly designed for field installation. Sub-assembly to consist of the following:
 - a. LED board.
 - b. Aluminum heat sink/chassis.
 - c. Mounting plate.
 - d. Power supply.
 - e. Internal ON/OFF toggle switch.

- f. Fuse.
 - 2. LED light source sub-assemblies will be built to UL8750 for LED Lighting Equipment and to UL1598C for Luminaire standards.
 - 3. The LED light sign box to consume zero (0) watts in the off-state, excluding any control devices.
 - 4. Installation instructions for all LED light source sub-assemblies to be provided by the manufacturer.
- C. LED Light Source Sub-Assembly for 1' X 4" Sign box:
- 1. Each sign box to consist of three (3) LED boards.
 - 2. Total electric power consumption for each sign box to be rated at 54 watts.
 - 3. Each LED board to consist of 54 LED chips with lumen outputs 38 per chip and color temperature 5000K.
 - 4. The LED board to be securely affixed to mounting plate so that it is not affected by vibrations.
 - 5. The chip manufacturer to be Samsung, Seoul Semiconductor, Cree, Philips, Nichia or other approved equal high quality industrial grade manufacturer.
- D. LED Light Source Sub-Assembly for 1' by 4" Angled Sign Box:
- 1. Each sign box to consist of two (2) LED boards.
 - 2. Total electric power consumption for each sign box to be rated at 54 watts.
 - 3. Each LED board to consist of 54 LED chips with lumen outputs 38 per chip and color temperature 5000K.
 - 4. The LED board to be securely affixed to mounting plate so that it is not affected by vibrations.
 - 5. The chip manufacturer to be Samsung, Seoul Semiconductor, Cree, Philips, Nichia or other approved equal high quality industrial grade manufacturer.

- E. LED Light Source and Light Engine Manufacturers:
1. LED color temperature 5000K.
 2. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
 - a. Cooper Lighting, 1121 Highway 74 South, Peachtree, Ga. 30269 (770) 486-4800.
 - b. Kenall Lighting, 1020 Lakeside Dr., Gurnee, Il. 60031 (847) 360-8200.
 - c. Seemart Corporate, 4139 Guardian St., Simi Valley, Ca. 93063 (805) 578-2536.
 - d. Sloan LED, 5727 Olivas Park Dr., Ventura, Ca. 93003 (888) 747-4LED.
 - e. Technilite Systems, 300 Milroy Dr., Peterborough, Ontario, Canada K9H, 7M9 (705) 741-5101.
- F. LED Power Supply:
1. Power supply to be Class 2 rated for a nominal input voltage of 120 to 277VAC with a voltage range of 108 to 305 VAC and a constant output voltage of 24VDC with an input frequency of 50/60 Hz, Nominal current of 2 Ampere, Current range of 1 to 2 Ampere, Current overshoot less than 20%, Ripple current less than 5 percent, and output voltage range of 18 to 24 VDC.
 2. Power Supply to be securely fixed to mounting plate so that it is not affected by vibrations.
 3. Power supply to carry UL and CE labels.
 4. Power supply to be rated for temperatures ranging from minus 40 to plus 90 degrees C. The power supply to be suitable for use in dry and damp locations. The Total Harmonic Distortion (THD) to be less than 20 percent. The power supply to have a power factor greater than 95 percent. The power supply to have an audible noise rating of Class A or better.
 5. Power supply line transient harmonics to comply with EN 61003-2 and EMC immunity to comply with IED 640004-4. Surge protection to comply with combination wave test procedures per IED 610004-5 and ANSI C62.41.
 6. The electronic power supply to be Philips Advance, Mean Well, Thomas Research Product, or approved equal. The power supply to be long-life (100,000 hours) and carry a five (5) year warranty. Manufacturer to be a full line power supply manufacturer with a ten (10) year history of producing power supplies for the North American Market.
 7. The power supply to conform to FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A).
- G. Lumen Depreciation:
1. Lumen depreciation per IESNA LM-80 is compared to the published lumen output of the product per IESNA LM-79 testing and reporting standards.
 2. Normal accumulation of particules on the optical surfaces to not be factored into the lumen depreciation.
 3. A Coloring Rendering Index (CRI) of 85 to apply to all LEDs.
- H. Light Engine Wattage:
1. Light engine wattage will vary by light sign box type.
 2. Light engine modules to provide nominal 4000 initial bare lumens.
 3. Life/lumen maintenance to provide greater than or equal to 70 percent of the initial lumens at 50,000 hours.

- I. Mounting Accessories:
 1. Provide mounting accessories including reinforcing, brackets, angles, channels, bent plates, faming, etc. as indicated on the drawings, specified, or as otherwise required for the installation of the signs.
 2. Plates, steel tubes, steel channels, steel bars, sheet metal, and all other mounting accessories to be galvanized after fabrication. Touch up galvanizing as required, apply one coat of primer and two coats of finish paint in the shop.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to installation, all signs to be inspected by the Authority. The purpose of this inspection is to verify quality of manufacture and conformance to requirements for the fabrication, color, artwork, etc. of each type of sign. Inspection will be conducted at the Contractor's premises, or at any other mutually agreeable location, within the City of Chicago. The Contractor to provide the Authority with a minimum of seven working days' notice prior to inspection.
- B. Installer of signs to verify all locations, sizes, installation and mounting conditions, type of anchorage required and working conditions in the field.
- C. A representative from the Authority may review the existing conditions with the installer prior to installation. The purpose of this inspection is to verify actual locations, method and quality of installation, mounting heights, interference with the installation, and other installation conditions for each sign. The scheduling of this inspection to be mutually agreed upon by all parties.
- D. After installation, a final inspection in the field will be conducted by the Authority. The purpose of this inspection is to verify quality of installation, correct location of signs, etc. The Contractor to provide the Authority with a minimum of seven working days' notice prior to inspection.

3.02 TESTS FOR SIGNBOXES

- A. Sign boxes to be submitted in accordance with the requirements of the Division 01 Section, "Submittals". The Authority will determine if the submittal is in compliance with the requirements of this specification prior to the final acceptance of the sign box. Contractor to submit one sample of each type of light sign box for approval of the Authority.
- B. Overall efficiency (sign box output in lumens/lamp lumens) to not be less than 50% for "B" and "E" sign boxes, and 45% for type "C" sign boxes.
- C. A minimum of 85% of the sign box lumens output to fall within 60 degrees from nadir for type "B" and "E" sign boxes and 90% of the sign boxes lumens output to fall within 120 degrees from nadir for type "C" sign box.
- D. The main beam to be at 90 degrees to the lens surface.

3.03 FACTORY INSPECTION

- A. Contractor to require the manufacturer's production facility available to the Authority for inspection before and after manufacture of the sign boxes called for under this contract.

3.04 INSTALLATION

- A. General: Install signs to match existing locations, heights, and mounting details unless indicated on the drawings or directed otherwise. Variations may be directed by or approved by the Authority's field representative during a pre-installation walk-thru or during the actual installation based on actual field conditions. Use approved mounting methods, mounting accessories, and attachment devices. No glue installations are permitted.
- B. Installation and anchorage to be solid and secure. Provide and install all indicated backer plates, frames, support, posts, hangers, and other mounting accessories. Provide and install any additional steel or wood framing or other support required. Where indicated or required, modify existing frame to accept new sign assembly.
- C. Install signs and all mounting accessories level, plumb, and flush with substrates. Sign surfaces to be free from distortion or other defects in appearance.
- D. Provide and install all required attachment devices, brackets, pendants and hardware. Fasteners and other accessories to be as specified for the application. Use expansion anchors, self-tapping screws, pop-rivets, bolts and nuts, etc. as required. Drill as required. Use countersunk screws where exposed or necessary. Exposed fasteners to be tamper resistant. Weld where indicated with full, tack, or stitch welds.
- E. Installation of Metal Frames, Supports or Hangers:
 - 1. Weld or bolt metal frames, supports, support posts, or hangers directly to the structure, track structure, beam, columns, light poles, railing, canopy fascia, or windbreak as directed. Use expansion anchors for securing frames, supports, or hangers to masonry or concrete.
- F. Installation of Pipe Hangers:
 - 1. Install flexible hangers where indicated, securing the pivot assembly to the canopy structure and to the sign frame or backer plate as directed.
- G. The Contractor to install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
- H. Where aluminum contacts concrete or dissimilar metal, separate contact surfaces with gasket, non-absorptive tape or bituminous coating to prevent corrosion. Use stainless steel fasteners. Aluminum sign boxes to not be installed in contact with wood, or in any other situation where permanent moisture can exist.
- I. In areas where industrial type sign boxes are to be installed such as Equipment Rooms, sign boxes which are near obstructions near the ceiling such as ducts, large pipes, groups of pipes, etc., to be suspended so that the bottom of the sign box is not higher than the bottom of the duct, etc. Outlets to not be located until the location of these obstructions are determined. Outlets to not be covered; conduits to be installed exposed. Sign box to have standard wire guard.
- J. Sign boxes to be mounted plumb, level and in straight lines. Group-mounted LED sign boxes to appear as one unit
- K. Lighting poles, when required, to be installed as shown on the Drawings. The installation is to result in vertically plumb poles, and will provide for a minimum of sign box vibration.

- L. The Contractor to supply all required LED lighting components, clean sign faces, diffusers, globes, reflectors and exposed-to-view surfaces of sign boxes after aiming and adjusting have been approved.
- M. The Contractor to provide gaskets and other means to make the sign box mounting and conduit entry watertight.

3.05 TESTING INSTALLATIONS

- A. The Contractor to furnish necessary personnel and equipment and perform tests and adjustments in the presence of the Authority. Schedule adjustment of exterior installations to occur during hours of darkness.
- B. The Contractor to test lighting circuits for continuity and operation.
- C. The Contractor to test sign boxes and mounting poles for continuity of grounding system. CTA MASTER SPECIFICATION, REV.0
- D. The Contractor to aim and adjust sign boxes to provide distribution patterns approximately as shown and as approved.
- E. Once tested and accepted by the Authority, Contractor to provide a minimum of 20 percent spare LED light sources (rounded to nearest whole number) for each type of light source provided.

3.06 CIRCUITING

- A. The Contractor to provide complete branch circuiting between panels and lighting sign boxes. Circuits to be as shown on the panel schedules.
- B. Final connection to light sign box to be with heat resistant wire of the following type:
 - 1. LED lighting 120 volt, Number 14 AWG Type THWN insulation

3.07 FIELD PAINTING

- A. Galvanized metals cut or drilled in the field to have its galvanized finish touched up in the field with approved galvanizing repair paint.
- B. Dissimilar metals: To avoid galvanic action, separate dissimilar metals with approved paint.
- C. Any mounting accessories such as angles, channels, plates, bent plates, clip angles, tubes, posts, etc. that will be exposed to view after installation of the sign, must be field painted to match the pre-finished backer plates. New wood posts and other members to also be primed and finished to match the backer plates.
- D. Care to be taken to not get paint on the new signs or any other existing surface.

3.08 CLEANING AND PROTECTION

- A. Signs to be adequately protected during their delivery and installation to prevent damage by scratches, marring, stains, discoloration, or other causes. The sign faces to be protected with a protective covering. The signs to be crated. Damage to any surface during fabrication, handling, shipment, storage, and installation to be remedied by the Contractor at Contractor's own expense. Replace any damaged signs that cannot be cleaned or repaired.

- B. Before delivery to the site, each sign to be tagged or labeled with the identifying number and installation location as shown in the specifications. Labeling to be on both the sign and the protective covering.
- C. At completion of the installation, remove the protective coating and clean soiled sign surfaces, and surfaces against which the new sign has been mounted, in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Authority.

END OF SECTION 26 55 60

SECTION 26 75 00
CABINET AND TERMINAL STRIPS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Section Includes:

1. Furnishing and installing of cabinet and terminal strips. The work under this section includes furnishing all labor, tools, equipment and incidentals necessary to install the terminal cabinet.
2. Interface terminal cabinets and terminal strips to provide adequate and proper space for all wires, connections, terminations, and taps.
3. Cabinets to be provided with suitable means for securing, supporting and adjusting the cabinets and trims.

1.03 RELATED WORK

- A. Cabinet and terminal strips specified are to be furnished and installed herein have related work in various other sections, including, but limited to:

1. Section 260100 "General Provisions"
2. Section 261950 "Identification"
3. Section 261230 "Wires, Cables, Splices, Terminations"

PART 2 PRODUCTS

2.01 INTERFACE TERMINAL CABINETS

- A. The Contractor to provide wall-mounted single-door enclosure with back panel, similar to Hoffman Engineering Company type A-12 or equal, as shown on the Contract Drawings, with the following additional requirements:
1. Enclosures for indoor locations to be formed of 12 gage galvaneal sheet steel minimum, seams continuously welded and ground smooth, without openings or knockouts, with external wall mounting brackets and collar studs for mounting panel. Back panels to be formed of 12 gage galvaneal steel. A rolled lip to be formed on all sides of the door opening. Size to be as shown on the Drawings.
 2. Doors to be formed of 12 gage galvaneal sheet steel with rolled lip along top and sides to mate with the enclosure. The door to be fitted with a removable print pocket and a closed-cell neoprene gasket attached with oil-resistant adhesive and bonding stud.
 3. Cabinet door to be equipped with a concealed full length, stainless steel continuous piano type hinge. Yale Company, Division of Eaton Security Products & Systems, Catalog Numbers 1400, or Corbin Cabinet Lock Company Catalog Number 1000 vault handles with disc tumbler locks and three point latch to be provided on doors twenty-four inches or over in height.
 - a. Yale Company, Division Eaton Security Product & Systems Catalog Number T 1403, or Corbin Cabinet Lock Company Catalog Number 1001

handles with disc tumbler locks and one point latch to be provided on doors under twenty-four inches in height.

4. Two keys to be furnished with each cabinet and lock. All cabinet locks to be provided to accept a CAT 60 Master Key (Corbin Lock or H. Hoffman Co.). Lock to be arranged to permit key removal in locked and unlocked positions.
5. Enclosure and door fabricated from galvaneal sheet steel to be primed and finished ANSI-61 light gray enamel, back pan to be painted white.
6. Enclosure to be provided with 21 circuit minimum panelboard style equipment ground bar mounted to the back pan.
7. For outdoor locations enclosure including door and back panel to be stainless steel. The cabinet to be Type 304 mill finish stainless steel. Handle to be provided as heavy duty pad lockable stainless steel and three point latch suitable for outdoor or subway locations.
8. Enclosures to bear U/L-508 industrial control label with respective UL enclosure rating based on the location of the installation and construction of the enclosure.
9. Enclosures to also be supplied with breather drains.

2.02 TERMINAL STRIPS

- A. Separate terminal strips to be provided to separate 120 volt AC control and input Interconnections and 48 volt DC interface connections to the CTA SCADA system.
- B. Terminal blocks to be UL/CSA recognized 94V, 2 thermoplastic material, snap on rail mounted design, 30 Ampere 600 volt, with marking strip, with Number 6-32 terminal screws for use with crimp on ring style wire connectors. Cooper Bussmann (USD) type NSS3-WH, Eaton type TBAL-30 or equal. 20 percent spare terminals to be provided.

2.03 WIRE DUCT

- A. Code approved wireways to be provided as necessary to provide separation of various voltages and routing of connected control wiring.
- B. Cross sectional area (wire fill) to be in accordance with the Chicago Electrical Code and to be sufficient for the maximum number of connections possible per terminal block row.
- C. Wire duct to be white in color, narrow slot design, UL Recognized, specially formulated lead free PVC material. Wire duct to have UL94V-O flammability rating and confirm with NFPA 79-2002 requirements for flame retardant material.
- D. Wire duct to be Panduit type F, or equal.

PART 3 EXECUTION

3.01 CABINETS

- A. Terminal strip cabinets generally to be installed with tops 6 feet-6 inches above the floor, unless otherwise noted on the Drawings.
- B. Cabinets to have fronts straight and plumb and arranged so the equipment will be centered in door opening.
- C. Each surface mounted cabinet to be supported and mounted away from the wall with "C" shaped channel. The channel to be fiberglass, when stray current control isolation is required, and stainless steel for normal applications. The minimum separation between the equipment and the wall to be one inch.

- D. Wiring entering the enclosure to be neatly bundled, routed and supported in the wire duct within the cabinet and to be connected to the terminal blocks with insulated ring tongue lugs.

3.02 IDENTIFICATION

- A. All wire and terminal strips to be labeled and marked as specified in Section 261950.
 - 1. "Identification".

END OF SECTION 26 75 00

SECTION 26 77 00
INFRARED HEATING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Section Includes: This specifies electric infrared heating devices and all appurtenances thereto required under Division 23 and 26.

1.03 RELATED WORK

- A. INFRARED HEATING specified to be furnished and installed herein have related work in various other sections, including, but limited to:
- | | | |
|----|----------------|--|
| 1. | Section 260100 | "General Provisions" |
| 2. | Section 261000 | "Basic Electrical Materials and Methods" |
| 3. | Section 261230 | "Wires, Cables, Splices, Terminations" |
| 4. | Section 261750 | "Local Control Panels" |

PART 2 PRODUCTS

2.01 GENERAL

- A. This Contractor to provide power and control circuitry for the heaters shown on the Drawings, and specified herein.
- B. This Contractor to furnish, install and connect all infrared heating units, as indicated on the Drawings.

2.02 ELECTRICAL HEATING LUMINARIES:

- A. Electrical infrared heaters, to be designed for outdoor application, and to utilize 2-1600 watt quartz lamps per unit. Units to be rated 208 volts single phase 60 hertz.
- B. Housings to be constructed of stainless steel and to have two cast stem mounting brackets. The reflector to be one piece, anodized aluminum and be replaceable. Internal wiring to be SF silicon glass insulated 12 gage wire. Push-pull butt sockets to be provided for lamp insulations. The fixture to have a UL label, and be complete with two quartz lamps and wire guards. The reflector to be designed to provide distribution as indicated on the schedules.
- C. Infrared electric heating luminaries to be as manufactured by Aitkens, or approved equal, and to be provided by the mechanical contractor.

2.03 CONTROLS

- A. The system controls to provide for turning the infrared heaters on from a local momentary contact pushbutton and automatically turning them off after a adjustable timed interval. The on-off function to be provided from a control panel located in the Electrical Room. The on-off function of the infrared heater located above the ADA gate at passenger stations to be controlled by the station attendant by a "T" rated switch at the kiosk.

- B. The control panel to conform to the requirements of Section 261750 "Local Control Panels", and to have a UL label.
- C. The contactor to be a electrically operated, electrically held, 60 Ampere, 600 Volt, 3 pole, with a 120 Volt coil. The contactor to be as manufactured by Square D Series 8903, or Allen Bradley Bulletin 500L.
- D. The timing relay to be, industrial type, with a adjustable off time delay of 1 to 10 minutes, set for 5 minutes. Switching contacts to be rated a minimum of ten amperes. Timing relays to be Agastat 7000 series or approved equal.
- E. The remote mounted pushbutton station to consist of a Joslyn Clark, 1 RNG-3 heavy duty palm pushbutton in a cast iron device box or by Rees Model No. 04960-412.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The infrared heating units to be installed, at a nine foot mounting height, in the location shown on the Drawings, and in accordance with the manufactures instructions.
- B. The heating control panel to be located in the Electrical Room supplied by the Electrical Contractor.

END OF SECTION 26 77 00

SECTION 26 95 00
ELECTRICAL TESTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. Section Includes:

1. This section of Specification covers the tests and checks that to be made on all electrical equipment and wiring to ensure compliance with the applicable codes and standards and with the Drawings and Specifications.

1.03 RELATED WORK

- A. ELECTRICAL TESTING specified to be furnished and installed herein have related work in various other sections, including, but limited to:

- | | | |
|-----|----------------|--|
| 1. | Section 260100 | "General Provisions" |
| 2. | Section 260300 | "Electrical Demolition" |
| 3. | Section 260500 | "Raceways and Boxes" |
| 4. | Section 261000 | "Basic Electrical Materials and Methods" |
| 5. | Section 261230 | "Wires, Cables, Splices, Terminations" |
| 6. | Section 261410 | "Wiring Devices" |
| 7. | Section 261700 | "Local Control" |
| 8. | Section 261750 | "Local Control Panels" |
| 9. | Section 261900 | "Grounding" |
| 10. | Section 261950 | "Identification" |
| 11. | Section 264700 | "Panelboards" |
| 12. | Section 265010 | "Lighting Fixtures" |

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor to test the equipment. The Contractor to contact the Authority two (2) weeks prior to the testing to provide sufficient notice for scheduling a representative of the Authority to be present for the testing.
- B. Whenever possible, all checks and tests to be made just prior to energizing the equipment or circuits and to be coordinated with the field schedule and field conditions.
- C. Before testing and energizing a system, all necessary precautions to be taken to ensure the safety of personnel and equipment. All conductors and all electrical equipment to be properly insulated and enclosed. All enclosures for conductors and equipment to be properly grounded. Insulation resistance measurements to have been made and approved on all conductors and energized parts of electrical equipment.

3.02 TESTING

- A. The following tests are required but to not be limited to this list. Tests to be observed and witnessed by the Authority.
1. Proper phase rotation.
 2. Short circuits.
 3. Improper grounds.
 4. Power and control electrical circuits for circuit continuity and function test.
- B. The Contractor to furnish all meters, instruments, cable connections, equipment or apparatus necessary for making all tests.

3.03 TESTS

- A. The Contractor to check and test all transformers, power panels, feeders, power and control cables, connections and motors to assure correct phase sequence and rotation. Phase sequence to be A-B-C as follows:
1. Top to bottom, left to right and front to rear when facing protective or disconnecting mechanism.
 2. Phasing to be accomplished by using distinctive colors for various phases, as indicated in Section 261230 Wires, Cables, Splices, Terminations.
- B. After wires and cables are in place and connected to devices and equipment, the system to be tested for short circuits, improper grounds, and other faults. If fault condition is present, the trouble to be rectified and the wiring system to be retested.
- C. Phase conductors, if shorted, grounded or at fault to be removed, to be replaced and the wiring system to be retested.
- D. A voltage test to be made at each lighting panel, distribution panel and at the last outlet on each circuit. If drop in potential exceeds one percent, the Contractor to correct the condition by locating the ground or high resistance splice or connection and retest.
- E. Any wiring device, electrical apparatus, or lighting fixture grounded or shorted on any integral "live" part, to be removed and the trouble rectified by replacing the defective parts or materials.
- F. Upon completion of the electrical work, the Contractor to place the entire installation in operation, test for proper function, and show systems and equipment to be free of defects. Motors and driven equipment to not be run until properly lubricated. Pumps to not be run until water or process fluid supply is connected and turned on. The Contractor to test and record motor maximum load amperage and terminal voltage when uncoupled and coupled for each motor.
- G. The Authority will observe from time to time such tests as may be required to any part of the equipment to determine if it is installed in accordance with specifications. The Contractor to extend to the Authority all facilities to this end and to furnish skilled or unskilled help required.
- H. All tests to be witnessed by the Authority and three copies of the verified test results to be given to the Authority promptly upon completion of a test.
- I. The Contractor to provide assistance to the various equipment manufacturers' field engineers as required in the testing and adjusting of the electrical power and control

equipment. Cooperation of the Contractor to be such that a minimum of time is required for equipment testing.

- J. A log to be maintained for all tests. This log to be certified before completion of the Project, both as to test value and date of test. All major equipment such as switchgear, and motors to be energized initially in the presence of the Authority.
- K. Any faults in the work performed by this Contractor or in materials or equipment furnished by this Contractor to be corrected or replaced promptly by this Contractor at Contractor's own expense. Any faults in materials or equipment furnished by the Contractor which are the result of careless, incompetent or improper handling or installation by this Contractor to be corrected or replaced promptly by this Contractor at the Contractor's own expense.
- L. All tests to be made at the Contractor's expense and certification of the tests to be submitted to the Authority. If any failures occur during the tests, the Contractor to replace the cable.
- M. All tests to be recorded on the following forms:

Form Number	Description
26 95 00-1	MULTIPLE CONDUCTOR CABLE MEGGER TEST, 300 VOLTS & LESS.
26 95 00-2	SINGLE & MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600 V AND LESS

FORM 26 95 00 - 1
 MULTIPLE CONDUCTOR CABLE MEGGER TEST, 300 VOLTS & LESS

WIRING - SIGNAL & COMMUNICATION CABLE

Testing to be performed before connecting the cables to the terminals at either end. Continuity of each conductor to be checked at this time.

Each conductor to be checked with a 500 volt megger to ground, with all other conductors in the cable and shield, grounded. The minimum acceptable megger resistance to be 50 megohms for each conductor to ground.

DATE _____
 PROJECT NAME _____
 FEEDER NUMBER _____
 LOCATION _____
 FROM MANHOLE _____ TO MANHOLE _____
 CABLE SIZE _____ CABLE LENGTH _____
 NUMBER OF CONDUCTORS _____ INSULATION TYPE _____
 MANUFACTURER _____ LINE VOLTAGE _____
 TEMPERATURE _____ HUMIDITY _____
 MEGGER TYPE _____ SERIAL NUMBER _____
 TEST VOLTAGE _____ MULTIPLIER _____
 REMARKS _____

CONDUCTOR NO.	MEGOHMS		CONTINUITY		CONDUCTOR NO.	MEGOHM		CONTINUITY	
	C/C	C/S	PAS	FAIL		C/C	C/S	PAS	FAIL

TEST PERFORMED BY: _____
Signature Date

TEST WITNESSED BY: _____
Signature Date

3.04 WIRE AND CABLE TESTING (600 VOLTS)

- A. The 600-volt insulated wires and cables to be factory tested prior to shipment in accordance with ICEA Standards for the insulation specified.
- B. The following 600-volt wires and cables to be tested after installation but before final connections are made up:
 - 1. All feeders from 208-volt switchboards.
 - 2. All feeders from 208-volt motor control centers.
 - 3. All feeders to 208-volt panelboards.
 - 4. All feeders to 208/120-volt lighting panelboards.
- C. For the above-listed wires and cables, a DC high potential test voltage, as specified in ICEA, to be applied for a period, as specified in the Standard, between all conductors specified in the Standard, between all conductors in the same conduit and between each conductor to ground.

END OF SECTION 26 95 00

SECTION 27 00 10
COMMUNICATIONS GENERAL PROVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. These specifications and drawings are intended to cover major communication items requested under this contract, however it is the Contractor's responsibility to include any and all materials, labor, engineering, integration, and testing required to provide a complete turn-key communication system at the location identified and integrated with the CTA's Control Center, compliant with the Specifications and Contract Drawings.
- B. This specification involves the installation of communications infrastructure as part of this construction project, including, but not limited to:
1. Fiber Optic and Copper Communications Cables
 2. OC-48 SONET Optical Communications Node
 3. Telephone System
 4. Public Address System modifications
 5. CCTV Security Camera modifications
 6. Communications Equipment Enclosures
 7. Communication Closet
- C. Communications Node: The Contractor to provide a new fiber optic communications node at the new Peoria St. Station including all necessary hardware and software to make the node operational and be compatible with the CTA's existing optical communications network. The Contractor to be responsible for all circuit assignments, programming, and wiring within the new node and the CTA's existing network to make this node operational.
1. The new node to integrate into the existing OC-48 SONET ring.
 2. The Contractor to provide the following general components at the node as a minimum, unless noted otherwise.
 - a. (1) OC-48 multiplexer (Alcatel-Lucent DMXtend R9.0 or approved equal)
 - b. (1) Fully equipped T-1 channel bank (Zhone Acculink Access Controller or approved equal)
 - c. (2) Ethernet switches (Cisco 3560X-48-E or approved equal)
 - d. (2) 48-port Category 6 data patch panels
 - e. (1) 16-DS1 DSX-1 cross-connect panel
 - f. (1) 96-port SC-type fiber connector housing
 - g. (1) 96-strand fiber splice housing
 3. The Contractor to provide a communications wall field in the Communications Room to terminate all field or premises cables.
 - a. Category-5e 25-pair Type 66 punch-down protected blocks
 - b. Category-5e 25-pair Type 66 punch-down non-protected blocks
 - c. Category-5e 25-pair Type 110 punch-down protected blocks
 - d. Category-3 25-pair Type 66 punch down protected blocks
 - e. 12-pole, sliding disconnect, binding post terminal blocks

- f. 4' x 8' x 1" marine grade plywood backboard
 - g. Copper grounding and bonding busbar system
 - h. Cable tray
 - i. AT&T NETPOP
4. Communications Hubs: The Contractor to provide new fiber optic communications hubs in the Station including all necessary hardware and software to make the hubs operational and be compatible with the CTA's existing optical communications network. The Contractor to be responsible for all circuit assignments, programming, and wiring within the new hub and the CTA's existing network to make these hubs operational.
- a. Hub Locations:
 - 1) Station House
 - 2) West Platform - existing
 - 3) East Platform - existing
 - b. Hub Components:
 - 1) (1) Cisco IE-3000 24-port switch (or approved equal)
 - 2) (2) 12-port Category-6 patch blocks
 - 3) (2) 12-strand pre-terminated SC-type fiber optic single panel housings with 12-strand environmental MT connector
 - 4) (2) Category-5e 25-pair Type 110 protected blocks
 - 5) (1) Power Distribution Panel, 24VAC
 - c. Hub-to-Hub InterConnect:
 - 1) 12-strand multimode Corning OptiTip pre-terminated fiber optic solution (or approved equal)
 - 2) 25-pair, Category-5e OSP outdoor rated cable
 - 3) 4/C power cable
- D. Public Address System: The Contractor to provide a complete public address system in the Peoria St. Station including hardware and software to make the PA system operational and be compatible with the CTA's existing master PA head-end system at the CTA's Control Center. The Contractor to be responsible for all circuit assignments, programming, and wiring within the new PA system and the CTA's existing PA head-end to make the PA system operational.
- 1. The existing PA head-end system at the Control Center is IED (Innovative Electronic Designs) GlobalCom enterprise solution.
 - 2. The Peoria St Station PA system to be an IP-based audio and digital signage system capable of broadcasting pre-canned, assembled audio library messages, live ad-hoc messages, and text-to-speech messages.
 - 3. Audio messages to be displayed in text form on the digital signage compliant with ADA regulations and recommendations for hearing impaired patrons.
 - 4. PA microphones to be IP-based, connected to network switches in communication hubs/room, and powered via POE injectors at communication hubs/room.
 - 5. PA speakers to be 70-volt, analog-based, connected via daisy-chain conductors as shown on the Contract Drawings. All speaker wiring to terminate on the wall field in the Communication Room and cross-connect to the PA equipment rack.
 - 6. Dynamic message signs to be LCD display panels with integrated PC, IP- based communications to communication hubs/room. The DMS to be integrated with the audio control system to synchronize visual text based messages with the

audio broadcast. DMS to display CTA's Train Tracker real-time train arrival information continuously between PA messages.

- E. Telephone System: The Contractor to provide new telephones in the Peoria St. Station including all necessary hardware and software to make the telephones operational and be compatible with the CTA's existing telephone network. The Contractor to be responsible for all circuit assignments, programming, and wiring with the new telephones and the CTA's existing telephone network to make the telephones operational.
1. The existing CTA telephone network is Avaya based. The existing hardware is located in the existing Communication Hut.
 2. Elevator hands-free emergency telephones to be provided by the elevator contractor. Elevator telephones to be integrated into the CTA's existing telephone network by the communications contractor.
 3. Help Point Telephones to be interfaced to the CTA's existing telephone network. The HPT, when activated, to dial the local CA Kiosk. If the CA kiosk does not answer, the call to roll-over to the CTA Control Center. The HPT to also trigger a Public Address audio and visual message for assistance over the speakers and DMS, interfaced to the PA system via the SCADA remote terminal unit in the Communications Room.
- F. Security Camera System: The Contractor to provide new CCTV security cameras including all necessary hardware and software to make the CCTV cameras operational and be compatible with the CTA's existing Video Management System. The Contractor to be responsible for all circuit assignments, programming, and wiring with the new CCTV cameras and the CTA's existing video network to make the cameras operational.
1. The CCTV cameras to be IP-based, high-definition, megapixel cameras compatible and interoperable with the existing Teleste VMX video management system
 - a. Fixed Dome Camera - Pelco IEE20 (or approved equal)
 - b. PTZ Dome Camera – Pelco SpectraHD (or approved equal)
 - c. 360 Camera – Sentry360 FS-IP-3000 (or approved equal)
 2. The existing head-end equipment is located in the existing Communication Hut.
- G. SCADA System: The Contractor to provide a new SCADA system in the Peoria St. Station including all necessary hardware and software to make the SCADA system operational and be compatible with the CTA's existing SCADA Master System at the Control Center. The Contractor to be responsible for all circuit assignments, programming, and wiring with the new SCADA system and the CTA's existing SCADA Master network to make the SCADA remote terminal unit and I/O devices operational.
1. The existing CTA SCADA Master System at the Control Center is CG Automation (QEI).
 2. All door contacts and alarm status relays to be wired to corresponding Interface Terminal Cabinets in the Electrical Room. The ITC to be connected to the wall field in the Communications Room for cross-connect to the RTU.

1.03 RELATED WORK

- A. COMMUNICATIONS GENERAL PROVISIONS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 05 13.13 "Dialtone Services"
 2. Section 27 05 26 "Grounding and Bonding For Communication Systems"

3.	Section 27 05 33	"Conduit and Backboxes for Communication Systems"
4.	Section 27 08 10	"Commissioning of Communications"
5.	Section 27 13 13	"Communications Copper Outside Plant Cable"
6.	Section 27 13 23	"Communications Fiber Optic Outside Plant Cable"
7.	Section 27 21 10	"Communications Backbone Network"
8.	Section 27 31 13	"PBX System"
9.	Section 27 32 13	"Telephone Sets"
10.	Section 27 32 26	"Help Point Telephones"
11.	Section 27 42 16	"Dynamic Message Signs"
12.	Section 27 51 17	"Public Address Speakers"
13.	Section 28 16 19	"Intrusion Detection Remote Devices and Sensors"
14.	Section 28 23 13	"Video Surveillance Control and Management System"
15.	Section 28 23 16	"Security Video Terminal"
16.	Section 28 23 19	"Network Video Recorder"
17.	Section 28 23 31	"CCTV Security Cameras"

1.04 REFERENCES

A. Technical Abbreviations and Definitions.

1. BICSI – Building Industry Consulting Service International
2. CCTV – Closed Circuit Television
3. CEC – Chicago Electrical Code
4. IEEE – Institute of Electrical and Electronic Engineers
5. NEC – National Electrical Code
6. NESC – National Electrical Safety Code
7. NFPA – National Fire Protection Association
8. OC-48 – Optical Carrier rate 48 (2.5Gbps)
9. PA – Public Address
10. RTU – Remote Terminal Unit
11. SCADA – Supervisory Control And Data Acquisition
12. SONET – Synchronous Optical NETWORK

B. Publications.

1. Chicago Electrical Code, 2012
2. NFPA 70: National Electrical Code, 2011
3. NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems, 2010
4. National Electrical Safety Code, 2012
5. BICSI Telecommunications Distribution Methods Manual (TDMM), 12th Edition

C. Reference Standards.

1. None.

1.05 QUALITY ASSURANCE

- A. Contractor's Quality Assurance Responsibilities: Contractor is solely responsible for quality control of the Work. Comply with the requirements specified elsewhere and as specified herein. The Manufacturer(s) of the system equipment to be submitted to the Engineer for approval. The Contractor to provide all of the data required for the Engineer's evaluation and to make all of the necessary arrangements for any required demonstrations and tests. The Contractor to certify that the proposed Manufacturer(s) to comply completely with all the requirements of this Contract.
- B. The proposed Manufacturer(s) to have, as a minimum, five (5) years experience in the successful manufacturing and installation of the specified items, unless noted otherwise, and to have a minimum of five (5) systems of size and complexity comparable to the system specified herein. Each system and components to have been on-line and operating satisfactorily for a minimum of twelve (12) months.
- C. The Manufacturer(s) to provide the names, addresses, and telephone numbers of operating personnel who can be contacted regarding the systems upon request. A demonstration of the system to be arranged upon request.
- D. The Manufacturer(s) to demonstrate a Quality Assurance Program that meets the intent of ASQC Q90; General Requirements for a Quality Assurance Program (US equivalent of ISO 9000). Compliance with the Quality Assurance Program to produce a thoroughly tested unit that will render long service life to the user and insure that malfunctions cannot be attributed to actions or lack of actions by the Manufacturer.

1.06 SUBMITTALS

- A. The Contractor to provide submittals in accordance with the section on Special Conditions, and section on General Provisions, of this Specification.
- B. The Contractor to submit complete sets of the following to the Engineer for approval prior to ordering any of the equipment specified in this Section. The Contractor to provide six (6) copies of product literature/catalog cuts, six (6) copies of shop drawings, and three (3) samples upon request.
1. Proposed Manufacturer's detailed product data "cut-sheets", specifications, and operations/installation/maintenance manuals for each piece of equipment to be furnished.
 2. Installation and demolition details of all communications material and equipment.
 3. Single line block and system diagrams detailing the communications system under this contract including all elements of system integration.
 4. A block diagram to be submitted showing interconnection between major independent elements, such as fiber optic cable, optical patch cord, fiber optic multiplexer, channel bank and distribution frames.
 5. Physical equipment layout in plan and elevation views.
 6. Wiring diagrams of distribution frames, equipment, and communications cables.
 7. Detailed testing procedures and certified copies of all test results and reports.
 8. All shop drawings as detailed herein.
- C. The as-built drawings to be prepared in AutoCad 2013 minimum, compliant with current CTA CAD standards, and delivered to IDOT and CTA in hardcopy and softcopy with all electronic base and reference files.

1. The installation drawings prepared to be updated during construction to document all as-built information to reflect accurate installation information.
2. All information to be provided by the Contractor to CTA for input to CTA's existing Infrastructure Management System database as elements are installed and inspected, compliant with CTA standards and procedures for electronic documentation of communications infrastructure.
3. The completed drawing hardcopies to be submitted to IDOT and the CTA for approval. System acceptance will not be granted until the as-built submittals have been approved.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.
- B. Handling: The equipment to be shipped on a pallet suitable for forklift handling. The equipment to be covered with clear plastic or other impenetrable sheeting to prevent dust, dirt and moisture from entering the equipment during shipment and storage.

1.08 WARRANTY

- A. Following successful completion of a 30-day Performance Test and Construction Acceptance, a Warranty Period to commence. The purpose of this period is to ensure that all components of the Communications System under this contract function in accordance with the Specifications over an extended length of time, and to provide continuing assistance to the Chicago Transit Authority in all phases of system operation as required. This consists of a 12 month Warranty Period. For a 12 month period, beginning at construction acceptance of the system, the Contractor to be responsible for the proper performance of all equipment.
- B. The Contractor to also be responsible for obtaining technical assistance from the equipment manufacturers and/or suppliers in cases where programming, operational or adjustment difficulties are encountered; the Contractor to be responsible for providing training to the CTA on any communications equipment if new or unusual problems/repairs are discovered during the Warranty Period. The Contractor to be responsible for correcting any problems attributable to poor workmanship and/or equipment.

1.09 TRAINING

- A. The Contractor to supply training for up to twelve (12) CTA designated personnel in all aspects of operation and maintenance of the communications system.
- B. The Contractor to provide all maintenance and operations training prior to any equipment being made operational in the field.
- C. Personnel thoroughly familiar with the operation of the equipment to provide training. This may be the Contractor's personnel, equipment manufacturer's representatives, or a combination of the two. A complete course outline and summary of the experience and qualifications of the instructional personnel to be submitted to the Engineer for approval prior to the start of training. Training sessions may be combined and/or shortened with the agreement of the Chicago Transit Authority and the Contractor.
- D. Recommended test equipment, literature and drawings for the classes to be furnished by

the Contractor. At the conclusion of classes, all items furnished, which are not currently owned by the Chicago Transit Authority, to become the property of the Chicago Transit Authority.

- E. All training class time (indoor and outdoor) to be video recorded by the Contractor on high quality DVD format for playback in a standard standalone and computer based DVD players. The video DVD(s) to become the property of the Chicago Transit Authority.

PART 2 PRODUCTS

2.01 [NOT APPLICABLE THIS SECTION]

PART 3 EXECUTION

3.01 [NOT APPLICABLE THIS SECTION]

END OF SECTION 27 00 10

SECTION 27 05 13.13
DIALTONE SERVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing DIALTONE SERVICES by the local telephone utility for the existing Peoria St. rail station, and the necessary work and materials to interface the telephone circuits at the locations as shown on the Contract Drawings.
- B. Local Telephone Utility Service: The Contractor to obtain the necessary services from the local telephone utility to furnish and install a new telephone service cable from the telephone manhole on Peoria St. north of the Peoria St. Bridge to the Main Station NETPOP in the Communications Room, as defined herein and as shown on the Contract Drawings. The Contractor to coordinate, order, test, and reimburse the local telephone utility for all utility charges for this work and to pay the utility all service costs until the system is accepted by the CTA.
- C. The Contractor to obtain the temporary services from the local telephone utility during construction. The existing NETPOP is located in the Telephone Cabinet on the Platform Level as shown on the Drawings.
- D. Dialtone Services to support the following:
1. Measured Business (MB) / POTS
 2. Payphone
 3. Leased Line (4-wire) Data
- E. The Dialtone Services cable provided by the utility from the utility manhole to the NETPOP to be a minimum of 25 pairs. The cable to comply with the local telephone utility's established standards.
- F. The NETPOP to be located in the Station House Communication Room. Any devices elsewhere in the station that require PSTN communications to use Owner cables, called "house cables", as shown on the Contract Drawings. Devices to connect over the "house cable" to termination blocks on the wall field in the Communication Room and cross-connect to the local telephone utility's NETPOP.
- G. Cross-connections from the wall field to the NETPOP to be performed by the local telephone utility.
- H. The Contractor to coordinate with the local telephone utility for all grounding and make them aware of the unique grounding system in the Station as a result of the elevated train structure floating ground. If the telephone utility requires Earth ground, the utility must isolate the ground from the Station ground and make provisions to avoid ground voltage potentials.

1.03 RELATED WORK

- A. Dialtone Services specified to be furnished and installed herein have related work in

various other sections, including, but not limited to:

1. Section 270010 "Communications General Provisions"

1.04 REFERENCES

A. Technical Abbreviations and Definitions. The abbreviations, acronyms and their definitions listed in Specification Item 27 00 10 – Communications General Provisions, Section 1.02, and those listed below may be used throughout this Section:

1. ATM – Automated Teller Machine
2. CPE – Customer Premises Equipment: Communication devices in the Owner system that connect to private and/or public telecommunications networks.
3. CSU – Channel Service Unit
4. DSU – Data Service Unit
5. MB – Measured Business line
6. NETPOP – NETwork Point Of Presence: Local telephone utility demarcation point where utility service cables terminate and cross connect to customer premises equipment.
7. PSTN – Public Switched Telephone Network
8. POTS – Plain Old Telephone Service: Traditional (dial-up) 2-wire analog telephone service from the Public Switched Telephone Network.

B. Publications.

1. None.

C. Reference Standards.

1. None.

1.05 QUALITY ASSURANCE

A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

PART 2 PRODUCTS

2.01 TELEPHONE SERVICE CABLE

- A. Telephone service cable for Dialtone Services to be furnished by the local telephone utility as part of the services obtained by the Contractor from the local telephone utility.
- B. Telephone service cable to be minimum 25 pairs.
- C. Telephone service cable to comply with local telephone utility's established cable standards.

2.02 NETPOP TERMINATION PANEL

- A. The NETPOP termination panel to be furnished by the local telephone utility as part of the services obtained by the Contractor from the local telephone utility.
- B. The NETPOP termination panel to be sized to terminate a minimum of 25 pairs, equal to or greater than the cable provided.
- C. The NETPOP termination panel to comply with local telephone utility's established standards.

PART 3 EXECUTION

3.01 TELEPHONE SERVICE CABLE

- A. Telephone service cable for Dialtone Services to be installed by the local telephone utility as part of the services obtained by the Contractor from the local telephone utility.

3.02 LOCAL TELEPHONE UTILITY NETPOP

- A. The NETPOP termination panel to be installed by the local telephone utility as part of the services obtained by the Contractor from the local telephone utility.

3.03 GROUNDING

- A. The Contractor to coordinate with the local telephone utility for all grounding and make them aware of the unique grounding system in the Station as a result of the elevated train structure floating ground. If the telephone utility requires Earth ground, the utility must isolate the ground from the Station ground and make provisions to avoid ground voltage potentials.

3.04 IDENTIFICATION

- A. All cable pairs, connecting blocks, and terminals to be labeled with circuit numbers and other relevant identifying information.

3.05 FIELD ACCEPTANCE TEST

- A. Following completion of the installation of the telephone service cable and the NETPOP, the Contractor to inspect all equipment and wiring to verify that all mechanical connections are made and properly secured, and all cable terminations are properly terminated. This inspection to include conductor and shield continuity and ground isolation verification of all installation wiring. This testing to be accomplished from the NETPOP in the Communication Room with a Telephone Butt Set on applicable pairs.

Data sheets containing evidence of such inspection, certified as correct by the Contractor's Quality Control Engineer for the project, to be delivered to IDOT and the CTA for approval. The Contractor to request from and to receive approval of such inspection certification before proceeding with further testing.

- B. In accordance with the local telephone utility's established installation procedures, provide Shop Drawings and As-Built record documents.

END OF SECTION 27 05 13.13

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS at the locations as shown on the Contract Drawings.
- B. The Contractor to furnish and install a complete Communication Infrastructure Grounding System as required by the Contract Drawings and as specified herein.
- C. The water main and structural steel to serve as the Code required reference grounding electrode.
- D. The Communications Room to have a continuous ground bus / bonding conductor around the perimeter of the room.
- E. The Telecommunications Main Grounding Busbar (TMGB) in the Communication Room to be the common point of connection for telecommunications grounding, with a Unit Bonding Conductor to the Station Electrical Room main ground bus.
- F. The TMGB to be installed below the Communications Room wallfield.
- G. A Telecommunications Grounding Busbar to be installed on the wall over the floor conduit entry area in the Communications Room with busbar insulator standoffs.
- H. A Grounding Bonding Conductor (GBC) to be installed on the walls around the perimeter of the Communications Room.
- I. Each transient protected telephone termination block on the wall field to be bonded to the TMGB.
- J. The telephone utility NETPOP to be bonded to the TMGB.
- K. The GBC from the TMGB to the Electrical Room main ground bus to be a green insulated #4/0 AWG conductor.
- L. The GBC around the perimeter of the Communications Room to be a bare #4/0 AWG conductor.

1.03 RELATED WORK

- A. GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:

- | | | |
|----|---------------------|---|
| 1. | Section 27 00 10 | "Communications General Provisions" |
| 2. | Section 27 05 13.13 | "Dialtone Services" |
| 3. | Section 27 13 13 | "Communications Copper Outside Plant Cable" |

- 4. Section 27 08 10 "Commissioning Of Communications"
- 5. Section 27 11 11 "Communication Room Finishes"
- 6. Section 27 11 16 "Communications Cabinets, Racks, and Enclosures"

1.04 REFERENCES

A. Technical Abbreviations and Definitions.

- 1. A.F.F. – Above Finished Floor
- 2. AWG – American Wire Gauge
- 3. BCT – Bonding Conductor for Telecommunications
- 4. BICSI – Building Industry Consulting Service International
- 5. CEC – Chicago Electrical Code
- 6. GBC – Grounding Bonding Conductor
- 7. GE – Grounding Equalizer
- 8. HRGB – Horizontal Rack Grounding Busbar
- 9. NEC – National Electric Code
- 10. NESC – National Electric Safety Code
- 11. NETPOP – NETwork Point Of Presence
- 12. ROW – Right Of Way
- 13. TBB – Telecommunications Bonding Backbone
- 14. TEBC – Telecommunications Equipment Bonding Conductor
- 15. TGB – Telecommunications Grounding Busbar
- 16. TMGB – Telecommunications Main Grounding Busbar
- 17. UBC – Unit Bonding Conductor
- 18. UL – Underwriters Laboratories

B. Publications.

- 1. Chicago Electrical Code
- 2. National Electric Code
- 3. National Electric Safety Code

C. Reference Standards.

- 1. ANSI/TIA-607-B, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- 2. ANSI/NECA/BICSI-607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
- 3. ANSI/IEEE 1100, 2005, Recommended Practice for Powering and Grounding Electronic Equipment
- 4. ANSI/IEEE C2, 2007, National Electrical Safety Code (NESC)
- 5. ANSI/ATIS 0600333, Grounding and Bonding of Telecommunications Equipment
- 6. ANSI/TIA/EIA-606-A, 2007, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 GROUNDING BONDING CONDUCTOR

- A. GBC to be:
1. Stranded copper wire
 2. Type XHHW
 3. Green insulated or bare, as required.
 4. 600 volt rated insulation
 5. Sized and installed in accordance with Code requirements, and as noted on the Contract Drawings.

2.02 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR

- A. The TMGB to be constructed of ¼" thick solid copper.
- B. The TMGB to be 4 inches high and be provided in lengths of 12 inches and 20 inches as required.
- C. The TMGB to have 2 rows of 9 pairs of attachment points for two-hole grounding lugs.
- D. The TMGB hole pattern for grounding lugs to comply with ANSI/TIA-607B and accept 15 lugs at 5/8 inch hole centers and 3 lugs at 1 inch hole centers.
- E. The TMGB to include wall mount stand-off brackets with insulators to provide a 4 inch wall standoff.
- F. The TMGB to be UL listed for grounding and bonding.

2.03 TELECOMMUNICATIONS GROUNDING BUSBAR

- A. The TGB to be constructed of ¼" thick solid copper.
- B. The TGB to be 2 inches high and be provided in lengths of 10 inches and 12 inches as required.
- C. The TGB to have 1 row of 7 pairs of attachment points for two-hole grounding lugs.
- D. The TGB hole pattern for grounding lugs to comply with ANSI/TIA-607B and accept 4 lugs at 5/8 inch hole centers and 3 lugs at 1 inch hole centers.
- E. The TGB to include wall mount stand-off brackets with insulators to provide a 4 inch wall standoff.
- F. The TGB to be UL listed for grounding and bonding.

2.04 BONDING ACCESSORIES

- A. Compression lugs to be manufactured from electroplated tinned copper.
- B. Compression lugs to have 2 holes spaced at 5/8 inch or 1 inch centers for connection to busbars.
- C. Compression lugs to be sized to accept specific conductors, #6 AWG to #4/0 AWG as required.
- D. Compression lugs to be UL listed for wire connectors.

PART 3 EXECUTION

3.01 GROUNDING BONDING CONDUCTOR

- A. GBC to be installed on the walls around the perimeter of the Communications Room:
 - 1. 12 inches A.F.F
 - 2. Insulator stand-offs 2 inches from the wall.
 - 3. Electrically and mechanically bond the GBC to the TMGB and TGB as required.
- B. GBC to be installed along the overhead cable tray in the Communications Room:
 - 1. Insulator stand-offs 2 inches from the cable tray outer wall.
 - 2. Electrically and mechanically bond the GBC to the HRGB as required.
- C. GBC insulated to be installed from the TMGB to the Main Station Electrical Room and bonded to the main grounding bus.
- D. The elevated steel structure that supports the Rapid Transit ROW to serve as the Code required reference grounding electrode. The Communications Infrastructure Grounding System must be isolated from Earth Ground and only be connected to Station Ground. Coordinate with Electrical construction for common grounding implementation.

3.02 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR

- A. TMGB to be installed on the wall below the wall field in the Communications Room:
 - 1. 12 inches below the wall field
 - 2. Busbar insulator stand-offs 4 inches from the wall
 - 3. Bond TMGB to perimeter GBC
- B. Conductor connections to the TMGB to be made with two-hole compression lugs, sized to fit the corresponding busbar holes and the conductor size.
- C. Each bond connection on the TMGB to be treated with antioxidant to prevent corrosion at the bond.
- D. Each lug to be attached with stainless steel hardware.
- E. Each protected telephone terminal block on the wall field to have a dedicated bond connection to the TMGB.

3.03 TELECOMMUNICATIONS GROUNDING BUSBAR

- A. TGB to be installed on the wall over the floor conduit entry area in the Communications Room:
 - 1. 12 inches A.F.F.
 - 2. Busbar insulator stand-offs 4 inches from the wall
 - 3. Bond TGB to perimeter GBC
- B. TGB to be installed on the wall over the floor conduit entry area and below the Communications Hub in the South Station Electrical Room:
 - 1. 12 inches below the Communications Hub
 - 2. Busbar insulator stand-offs 4 inches from the wall.
 - 3. The TGB to be bonded to the South Station Electrical Room ground busbar with #6AWG GBC.
 - 4. The Communications Hub enclosure to be bonded to the TGB.
- C. Conductor connections to the TGB to be made with two-hole compression lugs, sized to fit the corresponding busbar holes and the conductor size.
- D. Each bond connection on the TGB to be treated with antioxidant to prevent corrosion at the bond.
- E. Each lug to be attached with stainless steel hardware.
- F. Copper outside plant cable to be bonded to the TGB.

3.04 TESTING

- A. The Communications Infrastructure Grounding System to be tested with a resistance meter to confirm isolation from Earth Ground and continuity with Station Ground.

- B. Tests to be conducted:
 - 1. TMGB to Station Ground
 - 2. TGB to TMGB
 - 3. HRGB to TMGB
- C. Tests to be recorded and submitted to IDOT and the CTA.
- D. Refer to Electrical Specifications for grounding testing information.

END OF SECTION 27 05 26

SECTION 27 05 33
CONDUIT AND BACKBOXES FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing CONDUIT AND BACKBOXES FOR COMMUNICATION SYSTEMS at the locations as shown on the Contract Drawings.
- B. This section is in addition to raceways, boxes, and appurtenances specified under Division 26.

1.03 RELATED WORK

- A. CONDUIT AND BACKBOXES FOR COMMUNICATION SYSTEMS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"
 2. Section 26 05 00 "Raceways and Boxes"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. RTRC – Reinforced Thermosetting Resin Conduit
- B. Publications.
1. Chicago Electrical Code
 2. National Electric Code
 3. National Electric Safety Code
- C. Reference Standards.
1. UL 1684, Standard For Reinforced Thermosetting Resin Conduit

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification

Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 GENERAL

- A. All wire and cable to be installed in electrical raceways of the type specified herein and shown on the Drawings.
- B. Minimum size conduit to be 3/4 inch for RGS, 1-1/2 inch for fiberglass.
- C. Intermediate metal conduit (IMC) is not acceptable.

2.02 GALVANIZED RIGID STEEL CONDUIT

- A. Galvanized rigid steel (GRS) conduit and fittings to be installed in all above ground areas of this Project except as noted herein.
- B. GRS conduit to be heavy wall type, hot-dipped galvanized with zinc-coated threads, and Underwriters' Laboratory labeled.
- C. GRS conduit and couplings to be threaded, rigid steel, hot-dipped galvanized after fabrication and to be in accordance with UL 6.

2.03 RIGID NON-METALLIC CONDUIT

- A. Non-metallic rigid conduit to be used for underground feeders, service feeders, and under concrete slabs on grade.
- B. Non-metallic rigid conduit to be of the fiber glass reinforced epoxy type, minimum size of 1-1/2 inches in diameter.
- C. Fibre glass conduit to be composed of glass filament encapsulated in an epoxy matrix. Each conduit length to have an integral wound in expanded coupling. No threads or adhesives to be required to assure watertight joints for underground installations.
- D. Conduit to be suitable for continuous operation from minus 40 degrees C to plus 100 degrees C without significant change of mechanical properties. Conduit to be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for UV protection.
- E. Conduit to be UL listed.

2.04 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Liquid tight flexible metallic conduit to be used for termination at recessed light fixtures,

in non-plenum ceilings, motors, transformers, and installations subject to vibration.

- B. Liquid-tight galvanized steel flexible conduit to conform to UL 360. Fittings to be of a type designed to provide a liquid-tight continuation of the conduit system.

2.05 CONDUIT FITTINGS

A. Galvanized Rigid Steel Conduit:

1. All fittings to be; malleable iron; threaded type; hot dip galvanized or cadmium plated. Feraloy, aluminum, or threadless fittings are not acceptable and to not be provided.
2. All LB, LR, and LL fittings to have detachable cover, captive brass machine screws, and full neoprene gasket. All LB, LR and fittings to be NEC Series Mogul Type.
3. Locknuts to be malleable iron or steel, with non-slip notches.
4. All bushings to be of the insulated and grounding type.
5. Expansion couplings to have capability of four inch movement and be complete with flexible bonding jumper.

B. Rigid Non-Metallic Fiberglass Reinforced Epoxy Conduit:

1. All fittings to be composed of glass filaments encapsulated in an epoxy matrix.
2. All fittings to be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for ultra-violet protection.
3. All fittings to be suitable for continuous usage in ambient temperatures ranging from minus 40 degrees C to plus 100 degrees C without significant change of mechanical properties.
4. Fittings in all sizes to have inside diameters equal to the trade sizes.

C. Liquid-tight Flexible Metallic Conduit:

1. All fittings for use with liquid-tight flexible metallic conduit to require the use of a wrench during installation.
2. All fittings to; have a deep grip ferrule for thorough engagement of the flexible conduit and grounding continuity; provide high resistance to pull out of the flexible conduit from the fitting; withstand extreme external flexing, vibration and moist environments.

2.06 CONDUIT HANGERS AND SUPPORTS

- A. The Contractor to provide all necessary conduit hangers, and equipment supports or hangers, including all structural steel members and shapes, standard rods, nuts, bolts, concrete inserts, expansion shells, pipe brackets, tubing and conduit clamps, as indicated, hereinafter specified, or as required to support and/or suspend all equipment and conduit.
- B. Exposed conduit on walls or ceilings to be supported, a minimum of every five feet, with galvanized malleable iron one hole clamps and matching backs, utilizing anchors as specified herein.
- C. For concrete or brick construction, when stray current isolation is not required, insert anchors to be zinc alloy steel or steel anchors as manufactured by Ackerman-Johnson, Paine or Philips with noncorroding round head machine screws.
- D. For wood construction provide galvanized round head wood screws.

- E. For exposed work, where two or more conduits, one inch or larger are run parallel, trapeze hangers, spaced on five foot centers may be used.
- F. The Contractor to secure fasten conduits to each support with U-bolts, or conduit straps. Conduit supports to be as manufactured by B-Line, OZ/Gedney, Unistrut Corp., or approved equal. Supports to be held to concrete walls and ceilings by electro-galvanized steel inserts as manufactured by B-Line, Ramset, Unistrut Corp., or approved equal. Supports suspended from steel structure to be supported from drilled holes in the steel flange. The use of beam clamps for this work is not acceptable.
- G. The Contractor to provide hanger rods for trapeze-type hangers made from high tensile strength carbon steel not less than 1/2-inch diameter. The rods to have free-running, burr-free Unified National Coarse threads, with an electro-galvanized finish. Conduit supports to be located at intervals not exceeding 5 feet as required by City of Chicago Electrical Code.
- H. For exposed work attached to the support structure of the Rapid Transit right of way, conduits to be supported as shown on the Drawings. The use of beam clamps, and or trapeze type hangers for this work is not acceptable.
- I. The use of explosive force, hammer actuated, booster assist, piston drive, or like devices is strictly prohibited.
- J. The use of perforated strap hangers, plastic, or composition inserts is not acceptable.
- K. The Contractor to support vertical conduits by heavy wrought iron clamps or collars anchored in construction at each floor.
- L. Where threaded fasteners are provided, either a jam nut or aerobic thread sealant manufactured by Loctite or approved equal to be used.

2.07 OUTLET, JUNCTION AND PULL BOXES

- A. Outlet boxes, to be hot dipped galvanized sheet steel or cast ferrous metal conforming to UL 514, suitable for use in damp areas.
- B. Outlet boxes installed outdoors, on, or under the platform, to be cast iron type with a cast or malleable iron gasketed cover.
- C. Junction and pull boxes to be constructed of galvanized sheet steel, with continuously welded seams, and to be hot dipped galvanized after construction or cast Ferrous metal conforming to UL 50.
- D. The size to be as shown on the Drawings or required by the NEC and Chicago Electrical Code.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATIONS

A. General:

1. All conduits to be installed as required. The conduit system to be installed complete with all accessories, fittings, and boxes, in an approved and workmanlike manner to provide proper raceways for electrical conductors.
2. All conduit runs shown on the Drawings are shown diagrammatically for the purpose of outlining the general method of routing the conduits. Conduit to be run underground or in concrete slabs only when shown on the Drawings. It to be the Contractor's responsibility to avoid interferences.
3. Exposed conduit runs to be installed true, plumb, parallel with or at right angles to adjacent structural members, and must present an orderly, neat and workmanlike appearance.
4. Factory-made conduit bends or elbows to be used wherever possible in making necessary changes in direction. Field bends to be made with proper tools for the size and type of conduit being used. Field bends to be carefully made to prevent conduit damage or reduction in internal areas. The bending radius to not be less than six times the nominal diameters of the conduit, with carefully matched bends on parallel runs to present a neat appearance. The number of crossovers to be kept to a minimum.
5. All conduit cut on the job to be carefully reamed after threading, to remove burrs. All field cut threads to be tapered. No running threads will be permitted. Field cut threads on steel conduit to be given a coat of zinc dust in oil, or other approved compound.
6. All threaded joints to be watertight and ensure a low resistance ground path in the conduit system.
7. All conduits to be carefully cleaned before and after installation and all inside surfaces to be free of imperfections likely to injure the cable. After installation of complete runs, all conduits to be snaked with an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Any conduits through which the mandrel will not pass to be removed and replaced. After snaking, the ends of the dead-ended conduits to be protected with standard malleable metal caps to prevent the entrance of water or other foreign matter.
8. Lines of nylon or polypropylene, propelled by carbon dioxide or compressed air, to be used to snake or pull wire and cable into conduits. Flat steel tapes or steel cables may be used for branch circuit runs less than 50 feet long.
9. Where conduits are connected to boxes or equipment enclosures, drilled holes or full size knockout openings to provide electrical continuity for grounding and to be assured by the use of bonding type locknuts. Where connections are at eccentric or concentric knockouts, jumper type grounding bushings and wire jumpers to be installed.
10. At pull and junction boxes that have any dimension in excess of 18 inches and having a total of more than four conduit terminations, jumper type grounding bushings to be installed on conduit ends and jumper wires to be installed to bond all conduits and to bond conduits to boxes.
11. Communication conduit radius to not be less than 10 conduit diameters.
12. Conduit bends which are crushed or deformed in any way to not be installed.
13. Conduit systems to be installed, with fittings, double locknuts and bushings, and made up tight to insure ground continuity throughout the system.
14. Conduit connections to NEMA Type 3R enclosures to terminate in a threaded hub with an insulated throat to provide a positive seal, an electrical ground and a water tight connection. Each hub to be manufactured by Meyers, 0Z/Gedney Type CH-T, or approved equal.

- B. As far as practicable, conduit to be pitched slightly to drain to the outlet boxes, or otherwise installed to avoid trapping of condensate. Where necessary to secure drainage, a breather-drain fitting, to be installed in the boxes or trapped conduit at low points. Each breather drain fitting to be manufactured by Crouse-Hinds Co., Appleton Electric Co., or approved equal.
- C. Conduit to not run through columns or beams unless so specifically detailed on the drawings.
- D. The number of 90 degree bends to be limited to 3 or a total of 270 degrees including all offsets, sweeps, kicks, etc. This to include conduit runs between panelboards, switchboards, pullboxes, outlets boxes, fittings, or between outlets and fittings including bends located immediately adjacent to outlets or fittings. The maximum run without pull boxes to be 150 feet.
- E. The Contractor to furnish and install expansion fittings and bonding jumpers for the metallic conduit system where conduit crosses each building expansion joint, at each straight uninterrupted run of surface mounted conduit, or each vertical riser in excess of 100 feet and where conduits transfer between structurally independent buildings or supports. The distance between fittings as installed to not exceed 200 linear feet.
 - 1. Expansion fittings to provide for 8 inch movement and to include bonding jumpers.
 - 2. Expansion fittings to be Appleton XJ with XJB jumpers, Crouse-Hinds, OZ/Gedney, or approved equal.
- F. All wiring systems to be "pullable" and use of "BX" is prohibited.
- G. Conduits entering motor control center conduit compartments, free standing panels, and free standing control cubicles to be fitted with jumper type insulated grounding bushings, bonded together and to the structure of the enclosure by a continuous bonding wire.
- H. Conduits and concrete type boxes, masonry boxes, and other flush mounted boxes to be installed concealed in masonry walls, plaster walls, dry wall and concrete walls.
- I. All concealed conduits to be placed in walls, floors, ceilings, or ducts at the proper time, in accordance with the progress of the structural work.
- J. Concrete encased conduit runs extending through structural expansion joints to have fittings permitting longitudinal and lateral movement of the conduit ends without damaging the contained wires. The fittings to be watertight and include a grounding bond.
- K. Conduit runs that enter the building from outdoors are subject to moisture accumulation due to condensation. A pull box to be provided in the conduit run near the point of temperature change, to prevent trapping of moisture within the conduit system. A 1/4 inch weep hole to be drilled in the bottom of the pull box. After the wires and cables are installed, the end of the conduit continuing into the warmer area to be packed with a non-setting sealing compound.
- L. All communication, telephone, data and computer conduits to have a minimum separation of 12 inches from any AC power and control conduits.
- M. When work is not in progress, open ends of conduit and fittings to be securely closed so that no water, earth or other substance will enter.

3.02 CONDUIT CONNECTIONS TO EQUIPMENT

- A. The conduit system to be terminated at the conduit connection point of electric motors, devices, and equipment. Terminations of conduits at such locations to permit direct wire connections to the motors, devices, or equipment.
- B. Conduit connections to be made with rigid conduit if the equipment is fixed and not subject to adjustment, mechanical movement, or vibration. Rigid conduit connections to have union fittings, to permit removal of equipment without cutting or breaking the conduit.
- C. Conduit connections to be made with approved flexible metallic conduit if the equipment is subject to adjustment, mechanical movement, or vibration. Flexible conduit connections to be watertight.

3.03 OUTLET BOX INSTALLATION

- A. Boxes to generally be 4 inches square or octagonal except as follows:
 - 1. In masonry walls, where conduit is installed concealed, each box to be installed square cut masonry boxes.
 - 2. In concrete walls and floor slabs, where conduit is installed concealed, boxes to be suitable and constructed for installation in concrete.
 - 3. In exposed work, surface outlet boxes to be used for switches and receptacles.
 - 4. Outlet boxes for use with rigid conduit to be of the threaded hub, malleable iron cast metal type, with malleable iron cast covers and gaskets.
 - 5. In finished plaster walls, drywall, etc., raised device covers on outlet boxes to be provided.
 - 6. Where 1-1/4 inch conduits are required, the box size to be a minimum of 4-11/16 inches square.
- B. Proper covers on boxes mounted flush to be provided.
- C. All ceiling outlets to have adequate supports and to be equipped with adequate devices to carry and mount lighting fixtures provided fixtures do not weigh more than fifty pounds.
- D. An outlet box to be provided at each device location requiring one.
 - 1. Outlet box locations as shown on the Drawings to be considered as approximate only.
 - 2. Exact locations to be determined from the Drawings or from field instructions. The Contractor to coordinate box locations with the work of other trades.
 - 3. Boxes to be installed true and plumb, so that the covers or plates to be level and at uniform elevations for the type of outlets contained.
 - 4. Boxes for toggle switches and pilot lights at doorways to be located at the strike side of the door.
- E. There to be no more openings made in any box than are required for the conduits entering same. Depths of boxes to be such as to allow for easy wire pulling and proper installation of wiring devices.
- F. Switches and receptacles to be ganged in a common box only where the Drawings so indicate.
- G. Device Boxes:
 - 1. Recessed ceiling fixtures to have 4 inch square sheet steel box with cover and

suitable hanger bar. The box to be secured to the ceiling suspension members not more than 1 foot from the fixture opening.

2. Surface mounted ceiling fixtures, for plaster or dry wall ceilings, to have 4 inch sheet steel octagon box with round opening plaster ring and suitable hanger bar with 3/8 inch fixture stud.
3. Fixtures which weigh more than fifty pounds to be supported independently of the outlet box.
4. Surface mounted wall bracket fixtures (concealed conduit) to have 4 inch square sheet steel box with plaster ring as required for the fixture.
5. Ceiling outlets and wall bracket outlets (exposed conduit) in dry locations to have 4 inch sheet steel octagon box with 3/8 inch fixture stud.
6. Outlet boxes on exposed conduit run in wet or damp locations to have 4 inch cast box with threaded hubs and gasketed covers.
7. Wall switch and receptacle boxes installed in tiled or plastered walls to have 4 inch square sheet steel boxes or multigang boxes with proper tile or plaster ring as required. Two gang may be provided by means of 4 inch square box with two gang tile or plaster ring.
8. Wall switch and receptacle boxes in dry locations in brick walls, unfinished walls, woodwork, etc. to have single or multigang 4 inch square sheet steel boxes.

H. Plaster rings to have threaded ears and to be of suitable depth for the application.

I. The Contractor to provide boxes with metal barriers, baffles or separators for grouping of dis-similar conductors or system separation.

3.04 PULL BOX INSTALLATION

- A. Pull boxes to be installed where shown and where necessary to insure that finished cable will not be damaged.
- B. Pull boxes to be supported independently from the conduit system.
- C. The Contractor to add pull boxes where needed even though not shown on the Drawings.

3.05 FILLING OF OPENINGS

- A. Where conduit and raceway pass through interior fire-rated walls, ceilings or floors, the Contractor to provide seals to prevent passage of fire and fumes and to maintain integrity of fire-rated structure.
- B. The Contractor to close unused openings or spaces in floors, walls and ceilings, and plug or cap all unused conduit and sleeves.
- C. Where conduit passes through walls or floors which are below grade, the Contractor to provide watertight sealing fittings, OZ/Gedney Type W5K, or Approved Equal.

3.06 IDENTIFICATION

- A. Conduit runs to be identified as specified under Section 26 19 50 Identification.

3.07 FIELD QUALITY CONTROL

- A. The Contractor to arrange with the Engineer for inspection and approval of embedded conduit and boxes prior to concrete placement.
- B. The Contractor to test metallic conduit and boxes for electrical continuity. The tests to be

conducted in presence of the Authority.

END OF SECTION 27 05 33

SECTION 27 08 10
COMMISSIONING OF COMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing COMMISSIONING OF COMMUNICATION SYSTEMS at the locations as shown on the Contract Drawings.
- B. This Section describes the interfaces between the Contractor furnished items, existing items, and items provided by third parties for the rapid transit station/node. This Section also defines the division of responsibility for the Contractor.
- C. The Contractor to be responsible for design, development, installation and testing of each interface defined in this Section. The Contractor to verify that the interfaces to the operator work stations does not affect the operation of the actual subsystems.
- D. The Contractor to communicate with the contractors of other related contracts at the station to ensure compatibility and avoid unnecessary conflict. All interfaces to be handled through the CTA. The CTA to receive all requests for information and transmit the request to the appropriate party. The Contractor to receive the response to the request via the CTA within five (5) working days.
- E. All requests and responses to be confirmed in writing.
- F. The rapid transit station included under this Contract to be considered existing, unless otherwise noted. The station to receive complete subsystems as defined in related Sections.
- G. As part of the rail operations at the new control center, new equipment for this station to be integrated with existing equipment. Complete subsystems to be provided at this rapid transit station include:
1. Public Address
 2. Telephone
 3. CCTV
 4. Fiber Optic and Copper Backbone Network
- H. Each of the subsystems listed above to operate as a stand-alone system, independent of any other system. However, operator control of the subsystems to be integrated to the extent possible by using the existing control center hardware.
- I. The Contractor to be responsible for providing all wiring and cabling, conduit, backboxes and junction boxes necessary for complete and fully operational systems.
- J. The Contractor to provide all wiring and termination blocks, mounting hardware, labeling, cross-connect wiring, plywood backboard used for wall field and any other appurtenances required for a complete communications wall field at each node.
- K. All cable entrances to the communications room(s), in conduit provided by others, to be sealed after acceptance of cable installation to prevent the ingress of dirt or moisture.

- L. Communications room(s) to be visually inspected for obvious problems or deficiencies, such as leaking ceilings, power or lighting malfunctions, etc. by the Contractor prior to commencement of any work within the room. Such problems to be brought to the attention of the CTA.
- M. This section specifies the requirements for testing of the new communication system. The Work of this section to consist of integrated testing of the complete communication system and all subsystems thereof supplied under this Contract, and their external interfaces. The Contractor to perform these tests after successful completion of the Factory Acceptance Tests and the Local Field Acceptance Tests required by related Specification Sections.
- N. The Contractor to provide new fiber optic test sets with fiber and electrical interfaces for monitoring and troubleshooting of the CTA's fiber optic and copper transmission systems.

1.03 RELATED WORK

- A. COMMISSIONING OF COMMUNICATION SYSTEMS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
 - 1. Section 27 00 10 – Communications General Provisions

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
 - 1. RT – Rapid Transit
- B. Publications.
 - 1. None.
- C. Reference Standards.
 - 1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.
- B. The Contractor to submit all interface plans and schedules for approval to the CTA for interfacing with other contractors with related contracts. The schedules to also indicate any milestones. If any coordination with other contractors is required, it to be indicated in the schedules.
- C. For the equipment provided, submit the following:
 - 1. Manufacturer's Specifications (catalog cut sheets) for each product to be provided.

2. Factory Acceptance Test Procedures for each product.
 3. Factory Acceptance Test Reports - a certified copy for each item, demonstrating successful completion of the factory acceptance tests and compliance with the specifications.
 4. Local Field Acceptance Test Procedures for approval by the Engineer.
 5. Local Field Acceptance Test Reports for each installation showing satisfactory operation and performance to meet specifications.
 6. Integrated Test Plan for all installed equipment for approval by the Engineer.
 7. Test Procedures for approval by the Engineer for all tests required by the Integrated Test Plan.
 8. Test Reports for each test conducted.
- D. The Contractor to submit all interface plans and schedules for approval to the Engineer. The schedules to also indicate any milestones. The interface plans to include drawings indicating all electrical, communication and cable connections. All components to be properly labeled. If any coordination with other Contractors is required, it to be indicated in the schedules.
- E. In addition to the general submittal requirements specified in Section 27 00 10, the Contractor to include the following system test information in required submittals:
1. Factory Acceptance Test Procedures for each item.
 2. Factory Acceptance Test Reports - a certified copy for each item demonstrating successful completion of the tests and compliance with the Specification.
 3. For the Integrated Acceptance Tests of the complete Communication System, submit the following:
 - a. Test Plan - 60 days prior to the beginning of testing, to the Engineer for approval, a complete plan listing the test procedures that will be developed and used to test the Communication System and its subsystems as an integrated system, demonstrating its satisfactory end to end operation and conformance with every requirement of these Specifications. The tests to also demonstrate satisfactory operation with all external interfaces. Provide any revisions required upon review by the Engineer.
 - b. Test Procedures - 30 days prior to the beginning of testing, to the Engineer for approval, a procedure for each test in the approved Test Plan. Include for each test, data sheets showing the pass/fail value or range of values for each parameter to be measured. Provide any revisions required upon review by the Engineer.
 - c. Test Schedule - 30 days prior to the beginning of testing, to the Engineer for approval, a schedule for all tests in the approved Test Plan. Provide any revisions required upon review by the Engineer.
 - d. Test Notification – 48 hours prior to each test notify the Engineer of the date, time and place, so that arrangements may be made for witnesses if desired.
 - e. Test Reports - Provide to the Engineer within 2 weeks after each test a certified Test Report.
 - f. Variance Reports - Provide to the Engineer with each Test Report, a report of any failures to attain acceptable results. Include either of the following:
 - 1) Corrective action taken and retest results.
 - 2) Request, with complete justification for relaxation of the test requirements.

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 OPERATOR STATIONS

- A. The Contractor to design, furnish, install, and test all necessary hardware and software in order to integrate the above stated components into a working system. The Contractor to not be responsible for the Radio subsystem AND the SCADA subsystem, but to be responsible for the Public Address subsystem as well as the Telephone subsystem, and CCTV.
- B. This Section is to describe the interfaces between the Contractor furnished products, existing products, and products provided by others.
- C. Each of the operator stations to be connected to the local area network which to also connect the Public Address subsystem computer, the Radio subsystem computer and the existing SCADA subsystem computer. Each of these computers to be known as servers for the purpose of this Document.
- D. The Contractor for each of the subsystems to be responsible for supplying the necessary interface cards and software for their system to allow it to communicate over the network.
- E. Each of the stations to be identical in hardware and performance and be purchased from the same vendor.
- F. To access one of the subsystems, the operator to double click on an icon. Each subsystem to have its own unique icon. Only one function to be active at any one time on a given station.
- G. The Contractor to ensure that all of the functions that are available from the respective systems are available at the operator station.

2.02 PUBLIC ADDRESS INTERFACE

- A. As part of the control station, the Contractor to test a desktop microphone station for voice input and transmitting the voice input over the network to the Public Address controller and server.
- B. When an operator logs into the Public Address system, all of the functions that are available from the server console to be available from the operator station.
- C. The operator to be able to transmit a voice message as well as to hear the voice

message. As such, the Contractor to supply the necessary speakers.

2.03 ELEVATOR COMMUNICATION SYSTEM

- A. Communications between the elevator at the rapid transit station and the Control Center will be by means of telephone communications. The elevator will have a hands free, one button auto-dial telephone (provided by others) connected to the CTA PBX at the Control Center. The Contractor is responsible for the wiring and connection of the elevator telephone from the demarcation point at the station to the station communications room.
- B. The control center to be provided with a feature telephone set with display also connected to the CTA PBX, as specified elsewhere.
- C. When an elevator telephone button is pressed, the telephone to dial the respective attendant kiosk telephone or the control station telephone(s) if the kiosk phone goes unanswered. The operator to also have the option of dialing into any elevator on the RT system.

2.04 ETHERNET/TDR/DS-1 TEST SET

- A. The lightweight, handheld, modular, ruggedized test set to offer cable maintenance and service verification testing including: TDR, background noise, insertion loss, signal-to-noise, impulse noise, DMM, load coil detector, NEXT and FEXT, longitudinal balance, level meter, frequency generator, cable pair detect, and loop resistance.
- B. The test set to be provided with T1 testing capabilities including: BERT, loopback, fractional T1, VF DSO talk and listen.
- C. The test set to be provided with Ethernet 10/100 BaseT, 100 BaseFX, and Gigabit Ethernet testing capabilities at 850nm and 1310 nm wavelengths.
- D. The test set to have optical loss testing capabilities at 1310nm and 1550nm wavelengths.
- E. The test set to have the capability to act as a visual fault locator.
- F. The test set to have a high resolution color display that is easily readable under all lighting conditions, indoor and outdoor.
- G. The test set to be battery powered and field upgradeable.
- H. The test set to be provided with a carrying case.
- I. The test set to be compatible with existing CTA connector types.
- J. The test set to perform complete BERT and Performance Monitoring in compliance with ANSI, Telcordia and ITU-T standards.
- K. The Contractor to provide any incidentals and accessories necessary to ensure the test set is functional and compatible with the CTA's network.
- L. The handheld test set to be Sunrise Telecom model Sunset MTT, or Engineer approved equivalent.

2.05 OPTICAL MULTITESTER

- A. The multi tester mainframe to have the following features:

1. Display: Touch screen, 10.4in Active Matrix Color (TFT)
 2. Processor: Ultra-low power 300MHz Intel Celeron
 3. Memory: 256MB
 4. Operating System: Windows 2000
 5. Control Interface: Touch screen, cursor control, dedicated hard keys, and status LEDs
 6. Standard I/O Ports: USB (2), PC Card Slots (2), Ethernet 10/100 (1), IrDA (1), Video (1), PS/2 Mouse (1), Parallel (1), RS-232 Serial (1)
 7. Data I/O (modular): CD-ROM (standard), CD-RW
 8. Hard Drive: 13GB minimum
 9. Operating Temperature: 0°C to 45°C (32° to 122°F)
 10. Storage Temperature: -25° to 60°C (-13° to 140°F)
 11. Humidity: 95% max, non-condensing
 12. Power Supply: Battery: 6-8hrs typical (2 batteries); recharge time: < 3hrs; AC: 92-132V, 47-63 Hz; Autoranging: 12VDC operation
 13. Capacity: 4 module
- B. The multi-tester to offer an OTDR application for testing single mode and multimode fiber with a power meter, visual fault locator and light source with the following features:
1. Fiber Type: Single mode and Multimode
 2. Center Wavelength: 850nm ± 30nm and 1300nm ± 30nm; 1310nm ± 20nm and 1550 ± 20nm
 3. Spectral Width: < 15nm
 4. Dynamic Range: 850/1300nm – 25dB; 1310/1550 – 45dB
 5. The OTDR to be provided with a light source that has the following features:
 - a. Wavelength: 850/1300nm and 1310/1550nm
 - b. Output Power: -8dbM minimum
 - c. Output Fiber: Single mode
 - d. Modes of Operation: CW, 1KHz and 2KHz
 - e. Stability: ± 0.2db (8 hours)
 - f. Spectral Width: 850nm: <15nm; 1310nm: <15nm
- C. The multi-tester to be provided with a video inspection probe application which allows fiber optic connector to be viewed, stored and analyzed. The video probe to have the following features:
1. Magnification: 400x digital probe
 2. Connector Tips: Standard 1.2mm and 2.3mm Universal
 3. Operating Temperature: 0° to 50°C
 4. Storage Temperature: -20° to 50°C
 5. Software: Windows 2000
 6. Image Storage Format: JPEG, BMP, PNG
 7. The video probe to be provided with a hard case for the inspection microscope.
- D. The multi-tester to be provided with a talk set module that allows duplex communication over a single dark fiber to another multi-tester or a stand-alone fiber talk set. The talk set to have the following features:
1. Center Wavelength: 1550nm
 2. Dynamic Range: 45dB
 3. Transmission: Half Duplex
 4. Fiber Type: Single mode
 5. Range: up to 230km
 6. Power Supply: AC/Battery
 7. In addition to the module, the multi-tester to be provided with a spare headset

and the stand-alone talk set

- E. The multi-tester to be provided with a hard-shell carrying case, AC adapter and charger.
- F. All multi-tester modules to be compatible with existing CTA optical connectors. The Contractor to provide a bare fiber adapter for testing.
- G. The OTDR to be Corning Optical Multi-tester Model 500 or Engineer approved equivalent.

2.06 FIBER IDENTIFIER

- A. The fiber identifier to be a self-contained, handheld tool that identifies fiber path and transmission direction without disrupting service or opening points for identification.
- B. The fiber identifier to have the ability to detect a 2kHz test signal from a laser source to distinguish a single fiber from other active or dark fibers.
- C. The fiber identifier to be designed so as not to damage any fibers during, before or after proper use of the product.
- D. The minimum operating temperature range to be -20°C to 50°C .
- E. The fiber identifier to be provided with a leather carrying pouch, interchangeable adapters for testing 250um/900um coated fibers and 3mm jacketed fibers, and batteries.
- F. The fiber identifier to be Corning Checkpoint model or Engineer approved equivalent.

2.07 VISUAL FAULT LOCATOR

- A. The visual fault locator to be a hand-held, lightweight, visible laser light source used to isolate fiber breaks, improper terminations, bad splices, tight bends or crimps, damaged components, and other similar faults in both single mode and multimode fiber optic cables.
- B. The visual fault locator to be compatible with existing CTA optical connector types.
- C. The visual fault locator to be provided with batteries.
- D. The visual fault locator to be qualified as a maximum Class II laser product in accordance with IEC 825-2.
- E. The visual fault locator to be Corning Model VFL-350, or Engineer approved equivalent.

2.08 POWER METER

- A. The portable power meter to have the capability to simultaneously test and store dual-wavelength attenuation measurements.
- B. The power meter to have the capability to test single mode and multimode fiber at 1310nm and 1550nm wavelengths and to be compatible with existing CTA compatible connectors.
- C. The backlit display to be easily readable in all lighting conditions, indoor and outdoor.
- D. The power meter to be operational from 0° to 50°C .

- E. The power meter to be provided with a carrying case, AC adapter, and any other incidentals including jumper cables in order to perform the necessary tests on the CTA's network.
- F. The power meter to be Corning Model OTS-300 Express series.

2.09 FIBER TALK SETS

- A. The fiber talk sets to be a compact, lightweight, hands-free communications tool that provides full-duplex communication; with a typical 50dB dynamic range and typical 150km operating range over single mode fiber.
- B. The fiber talk sets to be operational at 1310nm and 1550nm and to be compatible with existing CTA optical connectors.
- C. The fiber talk sets to be operational from 0° to 50°C.
- D. The fiber talk sets to be provided with a carrying case and AC adapter.
- E. The fiber talk sets to be Corning FTS-300 series, or Engineer approved equivalent.

PART 3 EXECUTION

3.01 INSPECTION

- A. The Contractor to be responsible for inspecting all equipment ordered when it arrives on site. Any damaged equipment to be returned and replaced at the Contractor's expense.
- B. At the completion of the Contract, the Contractor to perform a site inspection to verify that all equipment supplied is in operable condition and contains no physical damages. Any piece of equipment deemed inoperable to be made operable by the Contractor prior to Contract completion. Any damaged pieces of equipment to be returned and replaced at the Contractor's expense. The site inspection to be performed with CTA personnel.
- C. The Contractor to ensure that all returned equipment is replaced within thirty (30) days. No schedule modifications to be allowed due to returned equipment unless authorized in writing by CTA.

3.02 OPERATOR STATIONS

- A. The Contractor to install and test all necessary hardware and software in order to integrate the above stated components into a working system. The Contractor to not be responsible for the Radio and SCADA subsystems, but to be responsible for the Public Address subsystem, the Telephone subsystem, and the CCTV subsystem.

3.03 ELEVATOR COMMUNICATIONS SYSTEM

- A. The Contractor to not integrate this feature with the network. This to be considered as a stand-alone system via the PBX. The Contractor to verify that communication can be established with the operating elevator at the station.
- B. The Contractor to verify that the display indicates the correct elevator number for the operating elevator at the station.

3.04 COMMUNICATIONS ROOM

- A. The Contractor to integrate the equipment furnished with the equipment in place to form a working Control Center and install in accordance with all Sections of this Specification.
- B. All equipment racks to be provided 120VAC feed from the main room power panel.

3.05 CABLING

- A. The Contractor to be responsible for connecting the required system equipment to the network via the concentrator. This to include all necessary cables.
- B. All cables installed to be properly tagged and recorded. The Contractor to supply the necessary drawings that to indicate the locations of each cable. The drawings to include the cable tags. The documentation associated with the drawings to include the cable tag, cable type, cable length and which components are connected to each end of the cable.

3.06 SYSTEM ACCEPTANCE TESTS

- A. The Contractor to perform all tests in accordance with the approved Test Plan and Test Procedures.
- B. Perform all tests in accordance with the approved Test Plan, Test Procedures and Test Schedule provided per Section 1.06.
- C. Provide complete reports of all testing in accordance with Section 1.06.

END OF SECTION 27 08 10

SECTION 27 08 43
UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. The work under this section includes furnishing all labor, materials, tools and equipment required to furnish and install concrete encased and steel reinforced ductbank as shown on the drawings.
- B. The work under this section includes providing manholes associated with the ductbank installation as shown on the drawings.
- C. Work includes conduit encased in concrete and conduit encased in reinforced concrete including, but not limited to; trench and backfill, steel reinforcement, concrete (aggregates, cements, water and add-mixtures), form-work including pre-made forms and all releasing agents; test batches of concrete; and all other appurtenant work required for this Item.

1.03 RELATED SECTIONS:

- A. Section 03 20 00 Concrete Reinforcement
- B. Division 26 Electrical
- C. Section 27010: Communications General Provisions
- D. Except as modified herein, the work must be performed in accordance with the applicable requirements of Special Conditions for Transportation Construction, and Additional Special Conditions, as well as the requirements of the General Conditions, Division 1, and this Section.

1.04 QUALITY ASSURANCE

- A. Except as modified herein, concrete work must conform to the applicable articles of IDOT SSR & BC and Division 1.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete to be composed of Type 1 Portland Cement, torpedo sand, washed gravel, water, and an approved type of air-entraining agent.
- B. Reinforcement to be provided as shown on the drawings and meet the requirements of Section 03 20 00 Concrete Reinforcement.

2.02 USE

- A. It is intended that the concrete of compressive strength specified herein must be used in

the construction of electrical work for conduit encased in concrete and conduit encased in reinforced concrete including, but not limited to; electrical manholes, electrical duct lines and conduits, light standard foundations used for public right-of-ways; and all other related work requiring the use of concrete.

2.03 QUALITY OF MATERIALS

- A. All materials used in producing ready-mixed concrete must comply with the requirements of the Standard Specifications as follows:
 - 1. Type I Portland Cement
 - 2. Torpedo Sand (#4 Sand for Concrete)
 - 3. Washed Gravel sizes as indicated
- B. If crushed stone is specifically requested instead of washed gravel, it must comply with the Standard Specification.

PART 3 EXECUTION

3.01 EQUIPMENT

- A. Ready-mixed concrete furnished under these specifications must be either Central-mixed Concrete or Transit-mixed in an approved stationary mixing plant and delivered to the job in an approved truck mixer operated at agitating speed. Transit-mixed concrete must be completely mixed in a truck mixer while at the yard and agitated in transit to the job site.
- B. Truck mixers must comply with the requirements of Article 803.01 (c) of the Standard Specifications.

3.02 MIX DESIGN:

- A. Unless noted otherwise, concrete must attain a minimum strength of 4,500 psi at 28 days.
- B. Minimum cement factor must be 5.65 cwt per cubic yard concrete.
- C. Maximum water-cement ratio must be 0.45.
- D. Range of air content must be 4 percent to 7 percent.
- E. Slump must be 2 inches to 4 inches.
- F. Coarse aggregate gradation must be CA-11.
- G. Prior to manufacture, Contractor must submit for approval the following:
 - 1. Concrete mix design.
 - 2. Concrete strength test data (cylinder breaks).
 - 3. Material certificates.
- H. The strength of concrete must meet the following requirements.

4000 Pounds Per Square Inch

@ 28 Days

Type of Construction	C.A. Size	Quantities Per Cubic Yard			
		Cement Bags	Water Gal.	Sand lb.	Gravel lb.
Pavement Machine Placed	2 inches to #4	5.8	29	1045	2150
Pavement Hand Placed	2 inches to #4	6.0	3.06	1080	2080
Structures	1-1/4 inches to #4	6.0	30.6	1120	2040
Thin Sections	3/4 inches to #4	6.5	33	1235	1820
Floor Topping	1/2 inches to #8	7.1	36.2	1385	1560

- I. The above tables show the basic mix requirements. The Contractor must be responsible for making adjustments for aggregate gradation and moisture in the aggregate. If crushed stone is ordered as coarse aggregate, the Contractor must adjust the fine aggregate to coarse aggregate ratio to allow for the angularity of the coarse aggregate.
- J. Slight adjustments may be made in the mortar-coarse aggregate ratio but the quantity of cement specified per cubic yard must be maintained.
- K. The Contractor must be responsible for adjusting the total water so that the consistency of the concrete as delivered must not exceed the following slumps:
 - 1. Mass Concrete & Pavements: 3-1/2 inch Max.
 - 2. Structures & Thin Sections: 5 inch Max.

3.03 MIXING AND DELIVERY

- A. In general the requirements for mixing and delivery of ready-mixed concrete must comply with Article 504.11 of the Standard Specifications.
- B. Delivery tickets must be furnished with each load of ready-mixed concrete furnished. No delivery of less than one cubic yard must be ordered.

3.04 QUALITY

- A. It is anticipated that concrete produced in accordance with these specifications must produce concrete of the compressive strength specified.
- B. The Contractor must be responsible for the quality, batching and mixing of concrete materials and for delivering concrete of the consistency and air content specified.
- C. The Commissioner reserves the right to reject any truckload of concrete that fails to comply with the specification requirements.

SECTION 27 11 11
COMMUNICATION ROOM FINISHES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specifications apply to this Section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing COMMUNICATION ROOM FINISHES for the preparation of the Communication Room at the new station as shown on the Contract Drawings.
- B. The Work under this section includes furnishing all labor, materials, tools, equipment, and incidentals necessary for the preparation of the Communication Room for fiber optic and other communications equipment.
- C. The Communication Room walls and floor to be thoroughly cleaned, painted, and sealed, lighting installed, and HVAC climate control systems installed to create an appropriate environment for operation of sensitive electronics. NO equipment racks or electronics to be installed in the room until the room construction, preparation, painting, lighting, and HVAC as been installed and accepted in order to prevent construction dust, dirt, and debris from contaminating the sensitive electronics.
- D. The floor and walls of the communication room to be thoroughly cleaned by removing all debris, dirt and grime, and to be primed for the application of paint and sealer, where applicable.
- E. The floors and walls to be sealed with at least two coats of a vapor-proof sealant, per manufacturer instructions, where applicable. After sealing, the floor to be primed and then painted with an epoxy paint floor cover. The floor paint to act as a contaminant barrier and provide a hard, yet elastic, durable, damage-resistant surface. The floor paint to be Dura-Seal 400 Tile Red Color or Engineer approved equivalent.
- F. The Contractor to apply a block filler (where applicable), primer, undercoat and then a white heavy duty glossy paint to the walls and any exposed conduit, per manufacturer instructions and as specified on the Contract Documents.
- G. All cable and conduit entry points to be sealed with fire rated caulk after acceptance of cable installation to prevent the ingress of dirt or moisture.
- H. The Communication Room door to include a bottom sweep threshold to prevent dust, dirt, and water from entering the room under the door.
- I. The Contractor to install cable trays in the room as specified in the Contract Documents. The Contractor to install wiring and cabling in the cable trays so that it is neat and orderly throughout the cable trays. All new wiring to also be carefully arranged on the cable trays so that the minimum bend radius of the cables are not to be exceeded.
- J. For any overhead HVAC units in Communication Room, the Contractor to install a drip pan below the unit to prevent water leakage on the communication equipment.

1.03 RELATED WORK

- A. COMMUNICATION ROOM FINISHES specified to be furnished and installed herein have related work in various other sections, including, but not limited to:

1. Section 27 00 10 – Communications General Provisions

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.

1. HVAC – Heating, Ventilation and Air Conditioning

- B. Publications.

1. None.

- C. Reference Standards.

1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

- B. In addition to the general submittal requirements specified in Section 27 00 10, the Contractor to include the following information in required submittals:

1. Shop Drawings of the room showing the proposed size, rack layout, location layout, and installation method.
2. Details of bus, connections, terminals, etc. including the complete ground bus arrangement and enclosure ground connections.
3. Single line diagram of equipment cabinet power connections.
4. Wiring diagrams showing AC electrical breaker panel servicing the room HVAC, lighting, communication cabinets, and other electrical equipment. Lighting switches and AC duplex receptacles along each wall to also be shown.
5. Samples for initial paint color selection in the form of the manufacturer's color charts.
6. Coating manufacturer's technical information, label analysis, and application instructions for each material proposed for use. List each material and cross reference the specific coating and finish system and application.
7. The coating manufacturer to submit certification that the products in a multi-layer coating system are appropriate for the intended use and are compatible with each other and with project substrates.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.
- B. For coating products, deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material
 - 2. Product description (generic classification or binder type)
 - 3. Federal Specification number, if applicable
 - 4. Manufacturer's stock number, if applicable
 - 5. Contents by volume, for pigment and vehicle constituents
 - 6. Thinning instructions
 - 7. Application instructions
 - 8. Color name and number
- C. The Contractors to maintain containers used in storage in a clean condition, free of foreign materials, and residue; keep storage area neat and orderly; remove oily rags and waste daily; and take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing and application.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 FLOORS / WALLS

- A. SEALANT
 - 1. The sealant to be a non-toxic, penetrating, and permanent concrete sealer.
 - 2. The sealant to act as a vapor barrier, alkali and corrosion inhibitor, curing agent and dust-proof compound.
 - 3. The sealant for the floor to be Moxie Flooring Sealant II (MFSII) or Engineer approved equivalent.
- B. MANUFACTURERS
 - 1. General Coatings: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:
 - a. Devoe and Reynolds Co. (Devoe)
 - b. The Glidden Company (Glidden)
 - c. Benjamin Moore and Co. (Moore)
 - d. PPG Industries, Pittsburgh Paints (Pittsburgh)
 - e. Pratt and Lambert (P&L)

- f. The Sherwin-Williams Company (S-W)
- g. ICI Dulux Paints (ICI)

C. PRIMER

1. Interior Flat Latex-Based Paint: Flat latex paint used as a primer over concrete and masonry under alkyd flat and semigloss enamel:
 - a. Devoe: 36XX Wondertones Latex Flat Wall Paint
 - b. Glidden: 5300 Ultra Hide Flat Wall Paint
 - c. Moore: Moore's Latex Quick-Dry Prime Seal #201
 - d. Pittsburgh: 80 Line Wallhide Flat Latex Paint
 - e. P&L: Vapex Latex Flat Wall Finish
 - f. S-W: Pro-Mar 200 Latex Flat B30W200
 - g. Engineer approved equivalent
2. Interior Flat Latex-Based Paint: Flat latex paint used as a primer on cement plaster under flat, semi-gloss, and full-gloss alkyd finishes:
 - a. Devoe: 36XX Wondertones Latex Flat Wall Paint
 - b. Glidden: 5019 PVA Primer Sealer
 - c. Moore: Moore's Latex Quick-Dry Prime Seal #201
 - d. Pittsburgh: 80 Line Wallhide Flat Latex Paint
 - e. P&L: Vapex Latex Flat Wall Finish
 - f. S-W: Wall and Wood Primer B49W2
 - g. Engineer approved equivalent
3. Galvanized Metal Primer: Primer used to prime interior and exterior zinc-coated (galvanized) metal surfaces:
 - a. Devoe: 13201 Mirrolac Galvanized Metal Primer
 - b. Glidden: 5229 Glid-Guard All-Purpose Metal Primer
 - c. Moore: Ironclad Galvanized Metal Latex Primer #155
 - d. Pittsburgh: 6-215/216 Speedhide Galvanized Steel Primer
 - e. S-W: Galvite HS B50WZ3
 - f. Engineer approved equivalent
4. High-Performance Latex Block Filler: Heavy duty latex block fillers used for filling open textured interior concrete masonry block before application of top coats:
 - a. ICI: 3010-XXXX Ultra Hide Interior/Exterior Acrylic Block Filler
 - b. Carboline: Flexide Masonry Block Filler
 - c. Moore: Moorcraft Block Filler #145
 - d. Pittsburgh: 6-7 Latex Masonry Block Filler
 - e. S-W: Heavy-Duty Block Filler B42W46
 - f. Engineer approved equivalent

D. UNDERCOAT MATERIALS

1. Interior Enamel Undercoat: Ready-mixed enamel for use on the interior as an undercoat over a primer on concrete or masonry under an odorless, semi-gloss enamel:
 - a. Devoe: 8801 Velour Alkyd Enamel Undercoat
 - b. Glidden: 4200 Spred Ultra Semi-Gloss Enamel
 - c. Moore: Moore's Alkyd Enamel Underbody #217
 - d. Pittsburgh: 6-6 Speedhide Quick-Dry Enamel Undercoater
 - e. P&L: E6 Enamel Undercoater
 - f. S-W: Prep Rite 200 Latex Wall Primer B28W200
 - g. Engineer approved equivalent

2. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on cement plaster under full gloss or odorless semi-gloss enamels:
 - a. Devoe: 8801 Velour Alkyd Enamel Undercoat
 - b. Glidden: 4500 Glid-Guard Enamel
 - c. Moore: Moore's Alkyd Enamel Underbody #217
 - d. Pittsburgh: 6-6 Speedhide Quick-Dry Enamel Undercoater
 - e. P&L: Interior Trim Primer
 - f. S-W: Wall and Wood Primer B49W2
 - g. Engineer approved equivalent

3. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on ferrous or zinc-coated metal under an interior alkyd semi-gloss enamel or full-gloss alkyd enamel:
 - a. Devoe: 8801 Velour Alkyd Enamel Undercoat
 - b. Glidden: 4200 Spred Ultra Semi-Gloss Enamel
 - c. Moore: Moore's Alkyd Enamel Underbody #217
 - d. Pittsburgh: 6-6 Speedhide Quick-Dry Enamel Undercoater
 - e. P&L: Interior Trim Primer
 - f. S-W: Pro-Mar 200 Alkyd Semi-Gloss B34 Series
 - g. Engineer approved equivalent

E. INTERIOR FINISH PAINT MATERIAL

1. The floor paint to be Dura-Seal 400 Tile Red color or Engineer approved equivalent.
2. Interior Semi-gloss Odorless Alkyd Enamel: Low-odor, semi-gloss, alkyd enamel for use over a primer and undercoat on concrete, masonry (including concrete masonry block), cement plaster, gypsum board, and both ferrous and zinc-coated (galvanized) metal surfaces.
 - a. Devoe: 26XX Velour Alkyd Semi-gloss Enamel
 - b. Glidden: 4200 Spred Ultra Semi-gloss Enamel
 - c. Moore: Moore's Satin Impervo Enamel #235
 - d. Pittsburgh: 27 Line Wallhide Semi-gloss Enamel
 - e. P&L: Cellu-Tone Alkyd Satin Enamel
 - f. S-W: Pro-Mar 200 Alkyd Semi-Gloss B34 Series
 - g. Engineer approved equivalent

3. Latex-based, Interior Flat Paint: Ready-mixed, latex based paint for use over plaster and gypsum board surfaces.

- a. Devoe: 36XX Wonder-Tones Latex Flat Wall Paint
- b. Glidden: 3400 Spred Satin Latex Wall Paint
- c. Moore: Regal Wall Satin #215
- d. Pittsburgh: 50-35 Latex Ceiling Paint
- e. P&L: Vapex Latex Flat Wall Finish
- f. S-W: Pro-Mar 200Alkyd Semi-Gloss B34 Series
- g. Engineer approved equivalent

- F. The primer and undercoat paint provided to be produced by the same manufacturer as the finish coats, where applicable.

2.02 ENVIRONMENTAL REQUIREMENTS

- A. The HVAC system to be a combination "climate control" unit designed to operate to maintain interior temperatures of minimum 50° F and maximum 90° F, with a nominal temperature range of 55-78° F. The unit to include an Ethernet IP interface with the ability to generate alarms for low and high temperatures, remote monitor and control of the unit via the IP network.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The walls and floor to be cleaned, painted, and sealed in a manner that does not damage, disturb, or degrade any wires, cables, conduits, equipment, and other ancillary devices.
- B. The block filler to be applied to concrete masonry block at a rate to ensure complete coverage with pores filled.
- C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixture and similar items in place that are not to be painted, or provide surface applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

END OF SECTION 27 11 11

SECTION 27 13 13
COMMUNICATIONS COPPER OUTSIDE PLANT CABLE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing COMMUNICATIONS COPPER OUTSIDE PLANT CABLE at the locations as shown on the Contract Drawings.
- B. The section specifies the requirements for furnishing, installing, and testing of the Copper Outside Plant portion of the Communication System within the RT station. This to be complete with copper twisted pair cable, with and without integrated messenger, ready access splice enclosures, circuit distribution frames, equipment racks, conduit, all as required for a fully operational system that provides all the features and functions identified herein and shown on the Contract Drawings.
- C. Description of Work: The Copper Outside Plant to accommodate distribution of all copper circuits under this Contract, to the fiber optic node. There is one 50-pair copper cable installed along the CTA Line. The copper cable to be rerouted to the new Communications Room through a new conduit. The copper plant uses the first 25 pairs of the cable to perform local distribution of copper circuits to fiber optic nodes. The second 25 pairs are used for point to point distribution to create an end-to-end distribution link. All cables must remain operational at all times. Cable cutovers to be coordinated with the CTA.
- D. The copper plant at the fiber node to be terminated on 25 pair protection blocks, as specified elsewhere. The copper plant to be interconnected from the protection blocks to punch down blocks on the wall field. All cross-connects to be made between the blocks from the cross-connect side of the blocks, as shown on the Contract Drawings.
- E. The copper plant also to include smaller density cables for drops to equipment and rooms as specified in Section 27 15 13 Horizontal Copper Cabling. All pairs to be terminated at the wall field within the communication room, as shown on the Contract Drawings.
- F. All materials, components, equipment, installation techniques and tools to comply with current CTA requirements and to be 100% compatible and interchangeable with the existing CTA backbone communication system.
- G. The Contractor to be responsible for providing complete and operational copper links as required to transport the signals to the copper transmission system. The complete link, including portions of existing cable or cable installed by others, to be measured and tested for performance and loss by the Contractor. The Contractor to notify the CTA immediately if any link measures below the necessary level to transport the copper signals.

1.03 RELATED WORK

A. COMMUNICATIONS COPPER OUTSIDE PLANT CABLE specified to be furnished and installed herein have related work in various other sections, including, but not limited to:

1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

A. Technical Abbreviations and Definitions.

1. OSP – Out Side Plant

B. Publications.

1. Telcordia TR-EOP-000063, "Network Equipment Building System (NEBS) Generic Equipment Requirements"

C. Reference Standards.

1. ANSI/EIA/TIA -T1.102, "North American Electrical Digital Hierarchy"
2. ANSI/EIA/TIA - T1.403, "Telecommunications Carrier to Customer Installation - DS-1 Metallic Interface"
3. RUS/REA PE-22, "Aerial and Duct Air Core Copper Conductor Cables"
4. RUS/REA PE-38, "Figure-8 Self-Supporting Air Core Copper Conductor Cables"
5. RUS/REA PE-89, "Foam Insulation Copper Conductor Cables"
6. RUS/REA PE-39, "Filled Core, Copper Conductor Cables"

1.05 QUALITY ASSURANCE

A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

B. Shop Drawings: The Contractor to prepare and submit to the CTA for review before fabrication and assembly of equipment, electronic files and four prints of each of the following. The Contractor to submit complete original sets (photocopies of printed material are not acceptable) of the following to the CTA for approval prior to ordering any of the equipment specified in this Section.

1. All submittals as required by the Special Conditions of this Specification.
2. The Contractor to submit the following items as specified herein:
 - a. All submittals as required by the Special Conditions of this Specification.
 - b. Proposed Manufacturer's detailed product data "cut-sheets" and specifications for each piece of equipment to be furnished.
 - c. Installation details of copper cable, and termination/splicing equipment.
 - d. Wiring diagrams of distribution frames, equipment racks, and the copper cable.
 - e. Detailed testing procedures and certified copies of all test results and reports, actual path loss measurement data.
 - f. All shop drawings as detailed herein.
 - g. Copies of the Contractors splice log.

- C. Record Drawings: Furnish record drawings annotated with the changes made during installation of the Work so as to be a complete set of "as-installed" drawings and wiring diagrams.
- D. Test Reports: The Contractor to submit for record and distribution after installation of equipment, 10 copies of the certified test report.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 COPPER COMMUNICATIONS CABLE

- A. The communications cable to be furnished under this Contract to conform to RUS/REA Specification PE-38 except as noted herein. The size, type, and location of the cables are as shown on the drawings.
- B. General Requirements
 1. The conductors to be solid annealed bare copper conforming to the latest requirements of ASTM-B-3.
 2. The conductors to be No. 22 AWG.
 3. Conductors to be individually insulated with a colored, solid insulating grade, high density polyethylene copolymer material meeting the requirements of RUS/REA Specification PE-200, "Polyethylene Raw Materials" for high density insulating grade material, and ICEA S56-434 fifth edition "Polyolefin Insulated Communication Cables for Outdoor Use".
 4. The polyethylene compound color to be coded per U.S. telephone industry standards with color concentrates chosen for permanency and electrical balance of individual circuits. The colors of insulated conductors to be supplied in accordance with ICEA S56-434 and to comply with the requirements of EIA Standard RS-359.
 5. The insulated conductors to be twisted into pairs. The length or pair twists to be designed to meet ICEA S45-434 fifth edition.
 6. The average twist length of any pair in the finished cable to not exceed six inches (6").
 7. The insulated pair to be twisted into specified color combinations to provide pair identification as well as low susceptibility to noise pick-up and with varying lay lengths to minimize cross-talk.
 8. The number of pairs to be as shown on the Contract Drawings.
 9. The insulated pairs to be assembled into a cable core. Cable cores of less than 25 pairs to be assembled concentrically. Cable cores of more than 25 pairs to be

formed of 25 pair units. Each 25 pair unit to be wrapped with a color-coded non-hygroscopic binder.

10. The finished cable core to be air core for aerial cables with integrated messenger, and filled core for cables without integrated messenger.
11. For filled cables, the filling compound, a petroleum jelly base multi- component, to be applied to the cable core in such a way as to provide as near to 100 percent fill of the available air space within the core as is commercially practicable. The filling compound to be applied in a manner to fill all voids and conductor interstices under the core to restrict the migration of moisture. The filling compound to be compatible with the insulation and other cable compounds. All underground duct and conduit installations to require filled compound cable (RUS/REA PE-39).
12. The filled core to be completely covered with a layer of non-hygroscopic, non-wicking polymeric tape applied with overlap over the cable core to ensure high dielectric strength from cable core to shield.
13. An inner jacket of virgin black high molecular weight polyethylene copolymer with a minimum thickness of 30 mils to be applied over the core wrap. The jacket to be free from holes, splits, blisters or other imperfections and to be smooth and concentric.
14. A 0.008 inch thick coated corrugated metal shield to be applied over the core. The shield to be applied longitudinally with overlap. Cables with integrated messenger to include an aluminum shield; cables without the integrated messenger to include a copper shield.
15. The space between the core tape and the shield, including its overlap, and between shield and jacket to be filled with a flooding compound designed to prevent moisture and/or water entry and migration.
16. The outer jacket to be of virgin, black, high molecular weight polyethylene copolymer, with a minimum wall thickness of 60 mils. The overall jacket to be sequentially marked at two foot intervals with cable type, year of mfg., footage, pair count, conductor size and Manufacturer. The jacket to be free from holes, splits, blisters or other imperfections and to be smooth and concentric.
17. The following factory tests to be performed, and test results submitted for approval by the CTA, prior to shipment of the cable.
 - a. Conductor insulation to be tested per REA Specification PE-38, PE-39, PE-22 and PE-23 for the following:
 - 1) Test Minimum Criteria
 - a) Tensile Strength 2,400 lb/sq in. minimum Ultimate Elongation 300% minimum
 - b) Shrink back 3/8 in. maximum.

- b. The jacket material to be tested per REA Specification PE-39, PE- 22 and PE-23 for the following:
- 1) Test Minimum Criteria
 - a) Tensile Strength 1,700 lb/sq in. minimum Ultimate Elongation 400% minimum Environmental Stress
 - b) Cracking 20% maximum
 - c) Shrink back 5% maximum
 - d) Impact Failure 20% maximum.
- c. The finished cable to be tested per REA Specification PE-39, PE- 22 and PE-23 for the following:
- 1) Test Minimum Criteria
 - a) Mutual Capacitance 0.072 +/- 0.004 mF/mi. Mutual Capacitance
 - b) Deviation 3% rms maximum
 - c) Mutual Conductance (1000Hz) 3.3 micro-ohms/mi. Pair-to-Pair Conductance
 - d) Unbalance 25 pF/1000 ft.
 - e) Pair-to-Ground Unbalance, (individual conductor) 800 pF/1000 ft. max.
 - f) Pair-to-ground Unbalance 175 pF/1000 ft. max.
 - g) Far End Crosstalk (150 kHz, average) 63 dB in 1000ft. RMS Near End Crosstalk (772 kHz) 56 M-S dB
 - h) Compartmental Core Cable
 - i) (772 kHz) 84 M-S dB
 - j) Insulation Resistance 1000 megohm/mi. High Voltage Test (3 sec.) (Conductor-to-Conductor 7 kV
 - k) High Voltage Test (3 sec.) (Conductor-to-Shield) 15 kV
 - l) High Voltage Test (3 sec.) (Conductor-to-Screen) 5 kV
 - m) Maximum Conductor
 - n) Resistance (20 C) 45.9 ohms/mi.
 - o) Maximum Average Attenuation
 - p) (1000 Hz at 20 C) 1.85 dB/mi.
 - q) Maximum Average Attenuation
 - r) (150 kHz at 20 C) 7.36 dB/mi.
 - s) Maximum Average Attenuation
 - t) (772 kHz at 20 C) 15.87 dB/mi.
 - u) Cable Bend Test No shield cracks
 - v) Shield Continuity Positive continuity

2.02 BUILDING ENTRANCE TERMINALS

- A. The Building Entrance Terminals to consist of twenty-five (25) pair protection punch-down blocks (Category-3 Type-66 or Category-5e Type-66/Type-110 as shown on the Contract Drawings) mounted to the wood backboard (wall field) in the Communications Room or Communication Hubs.
1. The building entrance terminal base to be made of high-impact resistant, flame-retardant plastic, fastened to a metal mounting bar. The IDC terminals, test field, and protector sockets to be mounted to this base.
 2. Each building entrance terminal to be equipped with an off-set mounting bracket for installing the block on a backboard.

3. Each building entrance terminal to be equipped a No. 6 AWG lug for a ground conductor.
4. Twenty-five (25) pair building entrance terminals to be provided for all required locations, as shown on the Contract Drawings. Cables larger than Twenty-five pair to use additional 25-pair building entrance terminals in combination.
5. The Category-5e, 110-type, 25 pair building entrance terminal to be Circa 1880ENA1/NSC-25e, or Commissioner approved equivalent.
6. The Category-5e, 66-type, 25 pair building entrance terminal to be Circa 2625QC/QCe, or Commissioner approved equivalent.
7. The Category-3, 66-type, 25 pair building entrance terminal to be Circa 2625QC/QC, or Commissioner approved equivalent

2.03 PUNCHDOWN BLOCKS

- A. The Punch down Blocks to consist of twenty-five (25) pair punch-down blocks (Category-5e Type-66/Type-110 as shown on the Contract Drawings) mounted to the wood backboard (wall field) in the Communications Room or Communication Hubs.
 1. The blocks furnished under this Contract for cross-connection of communications equipment to have four (4) columns of twenty-five (25) pair, terminations, embedded in an impact resistant molded plastic base, with a removable plastic cover.
 2. The terminations to accept No. 20 - No. 26 AWG insulated conductors and No. 18 - No. 19 AWG skinned conductors.
 3. The base of the block to have a 25 pair plastic fanning strip on each side of the split block. Each fanning strip to be permanently marked so as to identify the pair number (1 through 25) terminated on each clip. The base to be equipped with an offset mounting bracket for mounting to a wall or backboard.
 4. The Category-5e 66-type, 25-pair punch down block to be Hubbell HPW66M125, or Commissioner approved equivalent.

2.04 INDOOR SPLICE CLOSURES

- A. The Contractor to provide indoor copper splice closures adjacent to the wall field to splice the outside plant copper cable to cable stubs on protector blocks at the locations indicated on the Contract Drawings and as specified herein.
- B. Each splice closure to be non-metallic, re-enterable type to allow for access to, and inspection of, the splice.
- C. The splice enclosures to be installed in the Communication Room and to be sized to accommodate one 50-Pair #22AWG shielded OSP cable spliced to two 25- Pair #22AWG indoor rated, shielded cables.
- D. Splice enclosures to provide positive moisture and chemical resistance and to be fire retardant. All associated hardware and clamps to be stainless steel.
- E. The closure to be capable of accommodating the required number of copper splice connectors, as specified elsewhere.

2.05 READY ACCESS SPLICE CLOSURE (RASC)

- A. The ready access splice closure to be used for outside plant main cable splicing and for drop cable applications along the rail right of way.
- B. The ready access splice closure to be capable of aerial applications using separate messenger or integrated messenger installations.

- C. The RASC to be a weatherproof, re-enterable, plastic enclosure with separate areas or compartments for drop wire terminations away from the main splicing chamber.
- D. The RASC to be suitable for application in the temperature range of -40 degrees C to +70 degrees C.
- E. The RASC to provide entry of a minimum of three main cables and six drop cables, or as required in the Contract Drawing.
- F. The RASC to be capable of through, branch, or mid-span type splices.
- G. The RASC to allow splicing up to 250 pairs.
- H. The RASC to accommodate the required number of termination or splicing clips.
- I. The RASC to be fungus and UV resistant.

2.06 SPLICE CONNECTORS

- A. The Contractor to provide copper splice connectors for splicing copper cables at required locations, and as shown on the Contract Drawings.
- B. The splice connector to be capable of joining insulated conductors in gauges 17 through 26, without stripping the insulation.
- C. The splice connector to be encapsulated to prevent the ingress of moisture.
- D. The splice connector to be capable of providing splice, bridge, and half-tap options, in either fold back or in-line configurations.
- E. The splice connector to be provided in 5 pair and 25 pair modules.
- F. The splice connector to meet the following specifications:
 - 1. Di-electric Strength 3.0 AC kV
 - 2. Contact Resistance 1 in 10,000 failures at 1milli-ohm
 - 3. Temperature 40 to +60 degrees C
 - 4. Humidity 10 to 90 % relative
 - 5. Insulation Resistance > 20 x 10⁹ ohms at 1000VDCG.
- G. The Contractor to provide all necessary tools and appurtenances to properly splice or terminate 5 and 25 pair modules.
- H. The splice connector provided to be used in the indoor splice closure and the ready access splice closure, specified elsewhere.

2.07 PLUG-IN PROTECTION MODULES

- A. The Contractor to provide Plug-in Protection Modules (PPM) for the Building Entrance Terminals.
- B. The Plug-in Protection Modules to be 5-pin construction.
- C. The PPM to be compatible with and be of the same manufacturer as the Building Entrance Terminal.

- D. All pairs on each protective block to be protected, whether active or inactive.
- E. Plug-in Protection Modules to be type Cat-5e, rated for the level of voltage protection required for each type of circuit:
 - 1. 30v
 - 2. 75V
 - 3. 240v
 - 4. 300V
- F. The Plug-in Protection Module to be Circa 4B6S series, or Commissioner approved equivalent.

PART 3 EXECUTION

3.01 COPPER COMMUNICATIONS CABLE

- A. The installation of the copper cable to be conducted in a phased manner. The Contractor to make every effort to protect the cable during construction and installation, including protection from vandalism.
- B. The Contractor to perform the cable installation in accordance with the CTA approved plan that was submitted to the CTA. Any deviations from the approved plan must be submitted in writing to the CTA.
- C. The Contractor to, at all times, conduct the installation of the copper cable in a workmanlike manner identical to installations found in the telephone industry, and in complete conformance with the recommended practices of the manufacturer. The tensile ratings, minimum bending radius, and any other cable installation restriction to not be exceeded.
- D. The Contractor to give the CTA five (5) working days notice in writing of all copper cable installations so that authorized representative may be present, if necessary.
- E. All cable runs to be continuous from equipment demarcation to the wall field. No splices of any kind to be accepted between locations other than approved splice points or as shown on the Contract Drawings.
- F. All cable to be clearly marked and tagged to identify the cable origin, destination, function, and CTA designated identification number. Such tags to be of nylon or other CTA approved construction, with permanent mechanically printed markings.
- G. All cables to be grounded ONLY ONCE on the inbound end of the cable at each communication room. The outbound end to be left ungrounded. All cable splice and/or drop points to extend the ground through to the inbound end.
- H. Testing of the copper cable to be as follows:
 - 1. Manufacturer's Factory Tests. The Contractor to insure that each finished and installed copper cable segment to be traceable to the test date on file for each step in its manufacturing process.
 - a. The CTA, or its authorized representative, to have the right to make inspections and tests as are necessary to determine if the cable meets the requirements of this Specification. The CTA to have the right to reject cable which is defective in any respect.

- b. The CTA to be given ten (10) working days advance notice of the date the cable will be ready for final testing so that the CTA may be present at the tests, if it so elects.
- c. Physical tests to be made on samples selected at random at the place of production. Each test sample to be taken from the accessible end of different reels. Each reel selected and the corresponding sample to be identified. The number and lengths of samples to be as specified for the individual test. All applicable tests for the cable materials and cable construction specified to be performed.
- d. Attenuation tests to be made on the entire length of each continuous conductor provided within each copper cable. Each test to be completed during manufacture as required, and again prior to shipping, after the cable is secured to the reel in final shipping packaged form.
- e. The Contractor to conduct, at the point of production, the following cable tests, under the supervision of the CTA, to include, but not be limited to:
 - 1) Tensile Strength
 - 2) Impact Resistance, Crushing and Flexing
 - 3) Attenuation
 - 4) Mutual Capacitance
 - 5) Insulation Resistance
 - 6) Conductor Resistance
- f. Upon completion of each test, the Contractor to provide certified test results, and submit these results to the CTA for approval prior to shipping the cable.

2. Installed Field Tests. Testing of installed copper cable to be performed before and after installation, and after complete termination of the cable.

- a. The Contractor to notify the CTA in writing five (5) working days in advance of the testing of the cable so that the CTA, or its representative, may be present for the tests, if the CTA so elects.
- b. Testing to be performed on the copper conductors, as terminated on the wall field.
- c. All necessary test equipment to be provided by the Contractor to perform tests to include, but not be limited to, the following:
 - 1) Attenuation at 1000 Hz, 150 kHz, and 772 kHz
 - 2) Time Domain Reflectometer (TDR) records (labeled and identified), either photographic or computer printer/plotter output. Test to be conducted for both directions of transmission. All TDR tests to be made with a TDR approved by the CTA.

I. Existing Communications Cable

- 1. Contractor will locate and identify existing communications cable and will inform the CTA of their location.
- 2. Contractor will coordinate with the CTA for the staged removal of existing cables, as directed by the CTA.

3.02 BUILDING ENTRANCE TERMINALS

- A. The Building Entrance Terminals to be wall-mounted on a new marine-grade, fire-retardant gray painted wood backboard, unless noted otherwise, in the Communications Room, as shown on the Contract Drawings.

- B. All cross-connections to be made within each building entrance terminal from the punch down blocks, unless noted otherwise. Cross connections to be made using No. 22 AWG solid copper insulated pairs, dressed in a neat and workman-like manner.
- C. The cross-connections to only be made from the cross-connect side of each block, as shown on the Contract Drawings.

END OF SECTION 27 13 13

SECTION 27 13 23
COMMUNICATIONS FIBER OPTIC OUTSIDE PLANT CABLE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing COMMUNICATIONS FIBER OPTIC OUTSIDE PLANT CABLE at the locations as shown on the Contract Drawings:
- B. General: The section specifies the requirements for furnishing, installing, and testing of the Fiber Optic Outside Plant portion of the Communications System within the R/T station. This to be complete with fiber optic cable, innerduct with and without integrated messenger, splice and slack enclosures, pigtails and patch panels, and equipment racks, all as required for a fully operational system that provides all the features and functions identified herein and shown on the Contract Drawings.
- C. Description of Work:
1. One 96-strand single mode backbone fiber optic cable exists along the CTA Line Main Line Branch through the proposed work area.
 2. This cable to be rerouted to the new Communications Room under this project. All cables must remain operational at all times.
 3. Cable cutovers to be coordinated with the CTA.
- D. The cables are used for rail station and system communications. The Contractor to be responsible for continuing the cables to the fiber distribution panels in the communication room and providing splicing and termination equipment to keep the cables operational and functional. The Contractor to provide fiber distribution panels installed in the fiber cabinet and splice the designated fiber strands to the pre-terminated fiber pigtail connector panels or to respective outgoing fiber strands.
- E. The Contractor to provide the necessary optical connections between the fiber optic transmission system equipment and the fiber optic outside plant.
- F. The Contractor to be responsible for providing complete and operational optical links as required to transport the optical signals to the CTA Control Center. The complete link, including portions of existing cable or cable installed by others, to be measured and tested for optical performance and loss by the Contractor. The Contractor to notify the CTA immediately if any optical link measures below the necessary optical link budget to transport the optical transmission equipment, specified elsewhere.
- G. All materials, components, equipment, installation techniques and tools to comply with current CTA requirements and to be 100% compatible and interchangeable with the existing CTA fiber optic backbone communication system.
- H. These cables to be relocated under the platform after the station platform conduits are completed. Splicing and cutover of the relocated cables to portions of the existing cables to be coordinated with the CTA to avoid downtime.

1.03 RELATED WORK

- A. COMMUNICATIONS FIBER OPTIC OUTSIDE PLANT CABLE specified to be furnished and installed herein have related work in various other sections, including, but not limited to:

1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.

1. OSP – Outside Plant (cable)

- B. Publications.

1. ANSI/EIA/TIA-472, "Generic Specification of Fiber Optic Cables"
2. ANSI/EIA-472D000-A, "Sectional Specification for Fiber Optic Communication Cable for Underground and Buried Use"
3. ANSI/EIA/TIA-526-07, "Optical Fiber Systems Test Procedures - Optical Power Loss Measurements of Installed Single Mode Fiber Optic Plant"
4. ANSI/EIA/TIA-475-AAAA, "Detail Specification for Fiber Optic Connector Set; Type SC, Singlemode, Simplex and Duplex Versions"
5. ANSI/EIA/TIA-455-8, "Measurement of Splice or Connector Loss in Reflectance Using OTDR"
6. ANSI/EIA/TIA-609AA00, "Blank Detail Specification for Conventional, Permanent, Optical Fiber Splices"
7. ANSI/EIA/TIA-598-A, "Color Coding of Fiber Optic Cables"
8. ANSI/EIA/TIA-455, "Generic Fiber Optic Test Procedures", as applicable
9. ANSI/EIA/TIA-568, "Commercial Building Telecommunications Wiring Standard"

- C. Reference Standards.

1. Telcordia TR-TSY-000020, "Generic Requirement for Optical Fiber and Optical Fiber Cables".

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

- B. Shop Drawings: The Contractor to prepare and submit to the CTA for review before fabrication and assembly of equipment, electronic files and four prints of each of the following. The Contractor to submit complete original sets (photocopies of printed material are not acceptable) of the following to the CTA for approval prior to ordering any of the equipment specified in this Section.

1. All submittals as required by the Special Conditions of this Specification.
2. Single line block and system diagrams detailing the entire fiber optic outside plant system.
3. Proposed Manufacturer's detailed product data "cut-sheets" and specifications for each piece of equipment to be furnished.

4. Installation details of fiber optic cable, and termination/splicing equipment.
 5. Cable pulling plan.
 6. Cable bend radius warning per manufacturer's specifications.
 7. Wiring diagrams of distribution frames, equipment racks, and the fiber optic cable.
 8. Detailed testing procedures and certified copies of all test results and reports, including actual path loss measurement data.
 9. All shop drawings as detailed herein.
 10. Copies of the Contractors splice log.
- C. Record Drawings: Furnish record drawings annotated with the changes made during installation of the Work so as to be a complete set of "as-installed" drawings and wiring diagrams.
- D. Test Reports: The Contractor to submit for record and distribution after installation of equipment, 10 copies of the certified test report.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 FIBER OPTIC CABLE

- A. Mounting hardware for the Fiber Optic Cable to be as shown on the plans.
- B. The cable to meet, as a minimum, the following specifications and to conform with the latest issue of Bellcore TR-TSY-000020: Generic Requirement for Optical Fiber and Optical Fiber Cables, and ANSI/EIA-472: Generic Specification of Fiber Optic Cables, and appropriate Sectional Specifications thereof.
1. Cable Construction. Cable construction, other than as specified, must be approved by IDOT and the CTA. The cable to be constructed entirely from dielectric material.
 2. A cable suitable for the following installations to be supplied: direct installation into a duct bank; installation into an innerduct for underground installation or self-supported suspension between poles or supported from elevated structures, (e.g., within an aerially self-supported or figure eight innerduct).
 3. The cable to be of gel-filled, loose tube construction with up to twelve (12) buffer tubes wrapped around a dielectric central strength member. All fiber(s) to be contained within buffer tubes, and each buffer tube to have an inside diameter much greater than the total diameter(s) of the fiber(s) it supports.
 4. Each fiber or group of fibers to be free-floating within the tubes such that all mechanically or environmentally induced stress placed upon the cable is de-

- coupled from the fibers. The air within the buffer tubes to be displaced with a gel to prevent entry by water and to facilitate free movement of the fiber(s) within.
5. The fiber optic cable to conform to the latest issue of EIA/TIA-598, for color coding. Identification of buffer tubes and fiber strands to be such that they can be easily identified by field forces without the use of special equipment or tools.
 6. Cables constructed of less than six fibers to have a buffer tube provided for each fiber; cables constructed of more than six fibers may have several fibers occupy a buffer tube, with equal distribution of fibers as far as practicable. When more than one fiber occupies a buffer tube, the fibers to be color coded for identification.
 7. The cable to have a water block tape between the outer jacket and the buffer tubes applied longitudinally along the entire cable to prevent entry of water.
 8. A binder wrapping strength member of Kevlar, or approved equal, fibers to be provided as a final layer prior to application of the outer jacket.
 9. A low smoke, zero halogen, fire retardant fiber optic cable to be provided for all subway installations and as shown on the Contract Drawings. The cable to meet all specifications described herein for fiber optic cable.
 10. The cable to be provided in continuous lengths. Each fiber to be pulled from the same optical waveguide form and to be free of splices. Optical fibers are to be made from silica; the use of any other material must be approved by the CTA.
 11. A permanent marking to be employed on the outer jacket of the cable which to show the date of manufacture, the Manufacturer's name, and the words "CTA FIBER OPTIC CABLE". A numerical sequence to be marked on the outer jacket, at intervals no greater than ten (10) feet, to facilitate determination of length of cable and amount of cable remaining on the reel.
 12. All optical fibers to be proof tested by the fiber manufacturer at a minimum load of 100 kpsi, see submittals this section.
 13. All optical fibers to be 100% attenuation tested at the factory for compliance with performance specifications described herein. The attenuation of each fiber to be provided with each cable reel, see submittals this section.
 14. The outer jacket to be constructed of medium density polyethylene, minimum jacket thickness of 1.4 mm. Jacketing material to be applied directly over the tensile strength members and flooding compound. The outer jacket to be ultra-violet ray and fungus resistant.
 15. The cable used in the subway to be of low smoke, zero halogen, fire retardant manufacture that meets or exceeds National Fire Protection Association Standard 130.
 16. Fiber optic cable to be provided with the required number of strands as shown in the Contract Drawings.
- C. Optical and mechanical specifications for the standard fiber optic cable and the low smoke fiber optic cable:
1. Optical Specification:
 - a. Operational Wavelength: 1,300 nm and 1,550 nm
 - b. Optical Attenuation at 1,300 nm: 0.4 dB/km at 20 degrees C (max)
 - c. Optical Attenuation at 1,550 nm: 0.3 dB/km at 20 degrees C (max)
 - d. Optical Dispersion at 1,300 nm: 3.5-4.5 psec/nm-km (max)
 - e. Optical Dispersion at 1,550nm: more than 20 psec/nm-km (max)
 - f. Zero Dispersion Wavelength: 1290 to 1,330 nm
 - g. Fiber Core Diameter: 8.3 um, maximum
 - h. Fiber Coating Diameter: 250 +/- 15 um
 - i. Fiber Cladding Diameter: 125 +/- 3 um
 - j. Core/Cladding Concentricity: 1.0 um, maximum
 - k. Spot Size: 9.8 um
 - l. Refractive Index Difference: 0.3 +/- 0.5%

2. Mechanical Specifications:

- a. Crush Resistance: 5,000 N/m, length of cable
- b. Cable Outside Diameter: 11.9 mm (0.47"), nominal
- c. Minimum Bending Radius:
 - 1) Installation: 20 times the cable diameter
 - 2) Static: 10 times the cable diameter
- d. Temperature:
 - 1) Operational: -30 C to +60 C
 - 2) Storage: -40 C to +60 C (on reel)
 - 3) Humidity: 0 to 100%
- e. Tensile Strength:
 - 1) Installation: 2,700 N (600 lbf)
 - 2) Static: 600 N (135 lbf)

D. The fiber optic cable to be Corning ALTOS series, or Commissioner approved equivalent.

2.02 FIBER OPTIC CONNECTORS

A. All optical connectors to be factory installed on optical patch cords or pigtails. No field installation of connectors to be permitted. The single mode connectors furnished on optical patch cords and pigtails to be SC Type, physical contact (PC). The multimode connectors furnished on optical patch cords and pigtails to be ST Type. All connectors to conform with the latest issue of EIA/TIA-568 for ST connector performance and physical characteristics. The ferrule to be constructed from ceramic. The connectors to meet, as a minimum, the following specifications:

- 1. Nominal Insertion Loss: 0.25 dB, mated pair
- 2. Reflectance: less than -55 dB
- 3. Attenuation (Average, 3 readings, 120 degree spacing): 0.4 dB, maximum at 1300 nm
- 4. Mechanical Stability: 0.3 dB change, maximum
- 5. Tensile Stability: 0.3 dB change, maximum
- 6. Thermal Stability: (5 cycles, -20 degrees C to +60 degrees C), 0.4 dB change, maximum

2.03 OPTICAL PATCH CORDS AND PIGTAILS

A. The optical patch cords furnished under this Contract to consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends, of sufficient length.

- 1. Patch cords for connections within the fiber distribution panel (FDP) to be equipped with approved connectors on both ends of the patch cord, as specified herein.
- 2. Patch cords for connections from FDP to optical multiplexer to be equipped with the specified connector at the FDP end and a CTA approved connector at the equipment end.

B. The optical pigtails furnished under this Contract to consist of a section of single fiber, jacketed cable of sufficient length, equipped with an approved factory installed connector at one end. The other end to be stripped and prepared for fusion splicing. The pigtails to

be provided pre-wired to connector modules in the fiber distribution panel, as described elsewhere in this Section.

- C. The approved connectors furnished as part of optical patch cords and pigtails to meet or exceed the requirements for approved connectors specified herein.
- D. The fiber portion of each patch cord and pigtail to be a single, single mode, jacketed fiber with optical properties identical to the OSP cable furnished under this Contract. The fiber jacket to be a CTA-approved low smoke, low toxicity, flame retardant sheath. The jacketed fiber to have a tensile strength in excess of twenty pounds (20 lbs).

2.04 FIBER DISTRIBUTION PANELS

- A. Fiber Distribution Panels (FDPs) to be furnished and installed at the locations shown on the Contract Drawings and to consist of two parts: an optical splice shelf and an optical connector housing (patch panel).
 - 1. The splice shelf to house and protect a maximum of 144 fusion splices of OSP fibers to single mode fiber pigtails with twelve (12) feet of pigtail slack on each fiber.
 - a. The splice shelf to house a maximum of 12 splice trays.
 - b. Each splice tray to be capable of storing and protecting a maximum of 12 fusion splices with heat shrink protection, and to include a clear plastic tray cover.
 - c. The connector shelf and splice shelf to be Corning model CCH- 04U and CCS-03U or CTA approved equivalent.
 - 2. The optical connector housing to house and protect a maximum of 144 connectorized strands per shelf using duplex SC connectors. If more than 144 strands are used, the Contractor to provide additional shelves.
 - a. The fiber pigtail slack to be neatly coiled and secured in a manner that does not allow the minimum operational bending radius of the pigtail to be exceeded.
 - b. The approved type single mode connectors on the end of each pigtail to screw into a sleeve securely mounted to a panel within the FDP enclosure. The patch panel to be provided with pre-connectors and pre-wired 6-port duplex modules. The maximum optical loss across the connection to not exceed 0.25 dB.
 - 3. The FDP housings to be capable of rack mounting in EIA-310 standard 19" equipment racks, as shown on the Contract Drawings. The housing to have OSP cable entrances with cable sheath strain relief.

2.05 FIBER OPTIC SPLICE AND SPLICE ENCLOSURE

- A. All permanent and temporary optical splices in the system to be of the fusion type method.
 - 1. There to be no mid-span splices of the fiber optic cable, unless otherwise noted. All cables must originate and end at an optical node, fusion spliced to a fiber distribution panel or to another cable run.
 - 2. A factory fabricated fusion splice kit containing materials necessary for quality fusion splicing to be provided for each fiber splice.
 - 3. Splices made with the factory fabricated single mode fusion splice kit to be capable of achieving not more than 0.05 dB loss at 1310 nm.

4. An emergency restoration kit to be provided to perform temporary splices. This kit to include all necessary tools and materials to perform mechanical splices. Each mechanical splice kit to be capable of achieving not more than 0.1 dB loss at any wavelength.
 5. The Contractor to keep a log of all splices and testing thereof, see submittals this section.
- B. In the event that an outdoor splice is necessary, the Contractor to provide the following splice closure:
1. The outdoor optical splice enclosure to be capable of aerial, duct or buried applications.
 2. The splice enclosure to consist of an outer enclosure, an inner enclosure, and splice trays.
 3. The splice enclosure to be suitable for application in the temperature range of -40 degrees C to +70 degrees C.
 4. The splice enclosure to be capable of through, branch, or mid-span type splice locations.
 5. The splice enclosure to provide space allowing entry of fiber optic cable without exceeding the minimum bend radius of the cable.
 6. The splice enclosure to be designed to permit selective fiber splicing (looping a backbone cable in and out while only cutting into the desired fibers).
 7. The splice enclosure to allow splicing of all fibers up to the maximum number determined by the Contractor for the fiber optic cable.
 8. The outer enclosure to be waterproof, re-enterable and to utilize an encapsulate between the inner and outer enclosure to prevent the ingress of moisture.
 9. The inner enclosure to be designed to protect the buffer tubes and the splice trays.
 10. The splice trays within the inner enclosure to be capable of accommodating the required number of splices, including storage and protection of slack fiber.
 11. The inner enclosure to be re-enterable.
 12. The splice enclosure to include provisions to support the inner-duct entry to the enclosure utilizing compression fittings and clamps, in accordance with the manufacturer's recommended practice.

2.06 FIBER SLACK ENCLOSURES

- A. Fiber Slack Enclosures (FSEs) to be provided and installed as part of this Contract, in the locations as shown on the Contract Drawings.
1. FSEs to house and protect fiber optic cable slack in a manner which to allow the CTA access so as to accommodate construction moves and changes to the supporting cable messenger without any disruption to the integrity of the fiber optic cable.
 2. The FSE to be a galvanized steel NEMA 3R enclosure, wall or structure mounted. The FSE's to provide for weatherproof entry and exit of cable and innerduct from the sides and the bottom of the FSE.
 3. FSEs to be sized to accommodate a minimum of 100 feet of cable slack within the enclosure, stored in a manner that does not exceed the minimum operational bending radius of the cable at any time, however the enclosure to not be less than 36"H x 20"W x 8"D.
 4. FSEs to have provisions for entrance of the fiber optic innerduct, including compression fittings, seals, and other incidentals required for proper installation of the innerduct. The FSE to be designed such that the cable can be released and uncoiled from the enclosure via the front of the enclosure.

2.07 FIBER OPTIC INNERDUCT

- A. The innerduct to be provided with an integrated Figure-8 messenger cable capable of self-supported suspension for installation through the station. Innerduct without messenger to be provided for all conduit or duct bank installation of fiber cable.
- B. The innerduct to be a flexible high density polyethylene duct manufactured in accordance with NEMA Standards Publication No. TC7 and ASTM D3485.
- C. The high density polyethylene to be of Type III, Grade P34, Class B or C, Category 5, in accordance with ASTM D1248.
- D. The resin utilized in the manufacture of the duct system to meet or exceed ASTM standards.
- E. The nominal inside diameter of the duct to be 1.25".
- F. The ends of the duct to be sealed to prevent the ingress of dirt or moisture.
- G. The minimum crush resistance to be 4203 N/m.
- H. The maximum pulling tension to be 4448 N.
- I. A permanent marking to be employed on the outside of the duct which to show the date of manufacture and the Manufacturer's name. A numerical sequence to be marked on the outside of the duct, at intervals of five feet, to facilitate determination of duct length and amount of duct remaining on the reel. The words "FIBER OPTIC CABLE - CHICAGO TRANSIT AUTHORITY" to be permanently imprinted along the duct at fifteen foot intervals. All markings to be in English.
- J. The duct to be black in color and have UV radiation protection. The inside of the duct to have a permanent silicon emulsion pre-lubrication.
- K. The duct to be provided with a pull rope installed.
- L. The innerduct to be suitable for all installation methods described herein and in the Contract Drawings.
- M. The integrated messenger to be made up of 7-strand, galvanized steel, with a total diameter of 1/4". The messenger to have a breaking strength of not less than 10,000 pounds. The nominal webbing height and width for the integrated messenger to be .125", and .060" respectively.

PART 3 EXECUTION

3.01 FIBER OPTIC INNERDUCT

- A. The installation of the fiber optic innerduct and cable to be conducted in a phased manner. The Contractor to make every effort to protect the relatively delicate fiber optic cable within the innerduct during construction and installation, including protection from vandalism.
- B. Clamps and supports to be installed and spaced close enough together so that a clearance of no less than two (2) inches will be maintained between the innerduct and walls, structure members or posts and; at the same time, the innerduct to be well outside the car clearance line when applicable. This requirement to take into consideration tangents and curves.

- C. Messenger wire of the innerduct to be securely fastened to the supporting structure with brackets. Brackets to be attached with bolted connections only. Mounting holes must be drilled; burning or punching holes and other methods are not permitted. Steel structures to be drilled using a magnetic drill and the method approved by the CTA. Brackets may only be attached to locations approved by the CTA. Attaching brackets by means of welding is strictly prohibited.
- D. The innerduct and messenger to be drawn in place without injury to itself, its supports or fastenings and the tension therein to not exceed 25% of the strength of the messenger wire at 60 degrees Fahrenheit. This tension to be checked by a dynamometer. Messenger runs in lengths of 1,000 feet or less between dead ends may be installed using one dynamometer placed in series with the messenger at the point of application of the pulling tension. With the approval of the CTA, messenger runs in lengths of 3,000 feet between dead ends may be installed using two dynamometers with a shunt dynamometer to check the tension in the last span of the run in addition to the series dynamometer at the point of applying the tension. In all other respects the recommendations of the manufacturer to be followed in the installation as to sag, loading and tension, adjusted to 60 degrees Fahrenheit ambient temperature.
- E. All clamps, supports, dead ends, clevises, thimbles, turnbuckles, bolts and other parts required to support the messenger innerduct to be galvanized.
- F. The Contractor to, at all times, conduct the installation of the fiber optic innerduct in a workmanlike manner identical to installations found in the telephone industry, and in complete conformance with the recommended practices of the innerduct manufacturer. The tensile ratings, minimum bending radius, and any other fiber optic innerduct installation restriction to not be exceeded.
- G. The Contractor to give the CTA five (5) working days' notice in writing of all fiber optic innerduct installations so that authorized representative may be present, if necessary.
- H. All cable runs to be continuous from nodal site to nodal site. The innerduct to be continuous along with the cable, except at slack enclosures, or unless specified otherwise. No splices of any kind to be accepted between nodal sites or at locations other than approved splice points or as shown on the Contract Drawings.
- I. All innerduct to be clearly marked and tagged to identify the origin, destination, function, and CTA designated identification number. Such tags to be of nylon or other CTA approved construction, with permanent mechanically printed markings.

3.02 FIBER OPTIC CABLE

- A. The installation of the fiber optic cable within the innerduct to be conducted in a phased manner. The Contractor to make every effort to protect the relatively delicate fiber optic cable within the innerduct during construction and installation, including protection from vandalism.
- B. The Contractor to perform the cable installation in accordance with the CTA approved plan that was submitted to the CTA. Any deviations from the approved plan must be submitted in writing to the CTA.
- C. The Contractor to, at all times, conduct the installation of the fiber optic cable in a workmanlike manner identical to installations found in the telephone industry, and incomplete conformance with the recommended practices of the fiber manufacturer. The tensile ratings, minimum bending radius, and any other fiber optic cable installation restriction to not be exceeded.

- D. The Contractor to give the CTA five (5) working days notice in writing of all fiber optic cable installations so that authorized representative may be present, if necessary.
- E. All cable runs to be continuous from nodal site to nodal site. No splices of any kind to be accepted between nodal sites or at locations other than approved splice points or as shown on the Contract Drawings.
- F. All cable to be clearly marked and tagged to identify the cable origin, destination, function, and CTA designated identification number. Such tags to be of nylon or other CTA approved construction, with permanent mechanically printed markings.
- G. Testing of the fiber optic cable to be completed by the Contractor, as outlined below. The contractor to test the fiber optic cable before he performs the work and has the liability for any damage during construction. At the completion of the tests, the Contractor to submit Certified test reports for the CTA's approval, prior to shipping the cable. No cable to be shipped without the CTA's approval.
1. Manufacturer's Factory Tests. The Contractor to insure that each finished and installed fiber optic cable segment to be traceable to the test date on file for each step in its manufacturing process.
 - a. The CTA, or its authorized representative, to have the right to make inspections and tests as are necessary to determine if the cable meets the requirements of this Specification. The CTA to have the right to reject cable which is defective in any respect.
 - b. The CTA to be given ten (10) working days advance notice in writing of the date the cable will be ready for final testing so that the CTA may be present at the tests, if it so elects.
 - c. Physical tests to be made on samples selected at random at the place of production. Each test sample to be taken from the accessible end of different reels. Each reel selected and the corresponding sample to be identified. The number and lengths of samples to be as specified for the individual test. All applicable tests for the cable materials and cable construction specified to be performed.
 - d. Optical tests to be made on the entire length of each continuous fiber provided within each fiber optic cable. Each test to be completed during manufacture as required, and again prior to shipping, after the cable is secured to the reel in final shipping packaged form.
 - e. The Manufacturer to provide, at the point of production, apparatus and labor for making any or all of the following tests under the supervision of the CTA, to include, but not be limited to:
 - 1) Tensile Strength
 - 2) Impact Resistance, Crushing and Flexing
 - 3) Optical Attenuation
 - 4) Optical Spectral Dispersion
 - 5) Optical Time Domain Reflectometry (OTDR)
 2. Installed Field Tests. Testing of installed fiber optic cable to be performed before and after installation in the innerduct and after complete installation and termination of the cable.
 3. The Contractor to notify the CTA in writing five (5) working days in advance of the testing of the cable so that the CTA, or its representative, may be present for the tests, if the CTA so elects.
 - a. Optical testing to be performed on all fibers within each cable.
 - b. Testing to be performed on the fibers, as terminated on the FDPs.

- c. All necessary test equipment to be provided by the Contractor to perform tests to include, but not be limited to, the following:
 - 1) Optical attenuation 1,300 and 1,500 nm
 - 2) Optical Time Domain Reflectometer (OTDR) records (labeled and identified), either photographic or computer printer/plotter output.
 - 3) Test to be conducted for both directions of transmission.
 - 4) All OTDR tests to be made with an OTDR approved by the CTA.

- d. All testing, test equipment, and test report format to be compatible and comply with current CTA standards.

3.03 FIBER OPTIC SPLICE

- A. Fiber optic splicing to be performed in a clean dust-free environment. All outside plant splicing to be performed in a CTA approved splicing tent or splicing van.
 - 1. All splices to be tested for loss and reflection. Any splice which does not meet the performance specifications described herein to be redone, at no additional cost to the CTA.
 - 2. All fiber optic splices to use the fusion process.

END OF SECTION 27 13 23

SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing COMMUNICATIONS COPPER HORIZONTAL CABLING at the locations as shown on the Contract Drawings.
- B. Provide all horizontal copper cabling, terminations, patch panels, and cross-connection materials as required to interconnect all communication systems between station communication devices and locations including but not limited to:
1. Main Station Communications Room
 2. Center Station Communications Hub
 3. South Station Communications Hub
 4. North Platform Communications Hub
 5. South Platform Communications Hub
- C. Communications Horizontal Copper Cabling for this rail station to include the following types of cables and associated station communication devices:
1. Four-pair Category 6 UTP cable
 - a. Station Area CCTV Cameras
 - b. Station Area DMS
 - c. Station Area Telephones
 - d. Station Area Intrusion Detection Sensors
 - e. Station Area Touchscreen Information Signs
 - f. Station Area PA IP microphones
 - g. Station Area SVT
 - h. Station Area AFC
 - i. Station Area Vending Machines (data circuits)
 - j. Elevator Machine Room communication devices
 2. Four-pair Category-6 UTP OSP cable
 - a. Exterior Station Area CCTV Cameras
 - b. Platform and Walkway CCTV Cameras
 - c. Platform DMS
 3. Four-pair Category-6 shielded cable
 - a. Platform WAP
 - b. Station WAP

4. One-pair #16AWG shielded audio cable
 - a. Station area PA Speakers
 - b. Platform PA Speakers
 - c. Walkway PA Speakers
5. Three-pair #22AWG shielded audio cable
 - a. Station area PA Noise Sensor
 - b. Platform PA Noise Sensor
 - c. Walkway PA Noise Sensor
6. One-pair #18AWG instrumentation cable
 - a. CCTV Camera power to hubs
 - b. WAP power to hubs
 - c. Door Contacts to ITC
 - d. Intrusion Detection Sensor power to hubs
 - e. Blue Light Strobe power to hubs
 - f. Blue Light Strobe data to HPT
7. 25-pair Category 5e UTP OSP cable
 - a. Copper interconnect between Communications Hubs/Room

1.03 RELATED WORK

- A. COMMUNICATIONS COPPER HORIZONTAL CABLING specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
 1. Section 27 00 10 "Communications General Provisions"
 2. Section 27 32 13 "Telephone Sets"
 3. Section 27 32 23 "Elevator Telephones"
 4. Section 27 32 26 "Help Point Telephones"
 5. Section 27 42 16 "Dynamic Message Signs"
 6. Section 28 16 19 "Intrusion Detection Sensors"
 7. Section 28 23 16 "Security Video Terminal"
 8. Section 28 23 31 "CCTV Cameras"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
 1. AFC – Automated Fare Control
 2. ANSI – American National Standards Institute
 3. AWG – American Wire Gauge
 4. BICSI – Building Industry Consulting Services International
 5. CCTV – Closed Circuit Television
 6. DMS – Dynamic Message Sign
 7. EIA – Electronics Industry Association
 8. HPT – Help Point Telephone
 9. IEEE – Institute of Electrical and Electronics Commissioners
 10. IP – Internet Protocol
 11. ITC – Interface Terminal Cabinet
 12. PA – Public Address
 13. OSP – Outside Plant Cable
 14. SVT – Security Video Terminal

15. TIA – Telecommunications Industry Association
16. UL – Underwriters Laboratories
17. UTP – Unshielded Twisted Pair
18. WAP – Wireless Access Point

B. Publications.

1. None.

C. Reference Standards.

1. ANSI/TIA-568-C Commercial Building Telecommunications Wiring Standard
2. ANSI/TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/TIA-606-A Administration Standard for Commercial Telecommunications Infrastructure
4. ANSI/TIA-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
5. ANSI/TIA-758-A Customer-Owned Outside Plant Telecommunications Infrastructure Standard
6. ANSI/TIA-1179 Healthcare Facility Telecommunications Infrastructure Standard
7. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM), current edition

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.07 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.08 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 FOUR-PAIR CATEGORY 6 UTP CABLE

A. GENERAL:

1. Four-pair Category 6 UTP Cable to be Belden 2412, Commscope 1070A, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: U/UTP (unshielded twisted pair)
- b. Number of Pairs: 4
- c. Conductor Gage: 22-24 AWG
- d. Conductor Type: solid copper
- e. Pair Colors:

- 1) White/Blue Stripe and Blue
- 2) White/Orange Stripe and Orange
- 3) White/Green Stripe and Green
- 4) White/Brown Stripe and Brown

- f. Drain Wire: n/a

2. Electrical Specifications:

- a. ANSI/TIA Category: Category 6
- b. DC Resistance Unbalance, maximum: 5%
- c. DC Resistance, maximum: 8.0 ohms / 100 meters
- d. Mutual Capacitance: 5.6 nF / 100 meters at 1kHz
- e. Nominal Velocity of Propagation (NVP): 70%
- f. Operating Frequency, minimum: 250 MHz
- g. Operating Voltage, maximum: 80 V
- h. Transmission Standards: ANSI/TIA-568-C.2
- i. Safety Voltage Rating: 300V
- j. Dielectric Strength, minimum: 1500VAC; 2500VDC

3. Construction:

- a. Jacket Material: PVC
- b. Conductor Material: bare copper
- c. Insulation Material: polyolefin
- d. Separator Material: polyolefin

4. Environmental Specifications:

- a. Environmental Space: non-plenum
- b. Flame Test Method: CMR
- c. Operating Temperature: -20 degrees C to +60 degrees C
- d. Installation Temperature: 0 degrees C to +60 degrees C

5. Mechanical Specifications:
 - a. Outer Jacket Diameter: 0.230 inches
 - b. Jacket Thickness: 0.020 inches
 - c. Pulling Tension: 25 lbs

2.02 FOUR-PAIR CATEGORY 6 UTP OSP CABLE

A. GENERAL:

1. Four-pair Category 6 UTP OSP Cable to be Belden OSPU, Commscope 1571A, Hitachi 30180-8, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:
 - a. Cable Type: U/UTP (unshielded twisted pair)
 - b. Number of Pairs: 4
 - c. Conductor Gage: 22-24 AWG
 - d. Conductor Type: solid copper
 - e. Pair Colors:
 - 1) White/Blue Stripe and Blue
 - 2) White/Orange Stripe and Orange
 - 3) White/Green Stripe and Green
 - 4) White/Brown Stripe and Brown
 - f. Drain Wire: n/a
2. Electrical Specifications:
 - a. ANSI/TIA Category: Category 6
 - b. DC Resistance Unbalance, nominal: 3-5%
 - c. DC Resistance, nominal: 9 ohms / 100 meters
 - d. Mutual Capacitance: 3.0-6.0 nF / 100 meters at 1kHz
 - e. Nominal Velocity of Propagation (NVP), nominal: 65%
 - f. Operating Frequency, minimum: 250 MHz
 - g. Operating Voltage, maximum: 80 V
 - h. Transmission Standards: ANSI/TIA-568-C.2
 - i. Safety Voltage Rating: 300V
 - j. Dielectric Strength, minimum: 1500VAC; 2500VDC
3. Construction:
 - a. Jacket Material: medium density PE (polyethylene) or polyolefin
 - b. Conductor Material: bare copper
 - c. Insulation Material: polyolefin
 - d. Separator Material: polyolefin
 - e. Flooding Compound: gel-filled or water block tape
4. Environmental Specifications:
 - a. Environmental Space: outdoor; direct buried, aerial, conduit
 - b. Operating Temperature: -40 degrees C to +60 degrees C
 - c. Installation Temperature: 0 degrees C to +60 degrees C

5. Mechanical Specifications:
 - a. Outer Jacket Diameter: 0.25 inches, nominal
 - b. Jacket Thickness: 0.020 inches
 - c. Pulling Tension: 25-35 lbs

2.03 FOUR-PAIR CATEGORY 6 SHIELDED CABLE

A. GENERAL:

1. Four-pair Category 6 F/UTP Cable to be Belden 1351A, Commscope 1271B, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:
 - a. Cable Type: F/UTP (foil shielded cable/unshielded twisted pair)
 - b. Number of Pairs: 4
 - c. Conductor Gauge: 22-24 AWG
 - d. Conductor Type: solid
 - e. Pair Colors:
 - 1) White/Blue Stripe and Blue
 - 2) White/Orange Stripe and Orange
 - 3) White/Green Stripe and Green
 - 4) White/Brown Stripe and Brown
 - f. Drain Wire: tinned copper
2. Electrical Specifications:
 - a. ANSI/TIA Category: Category 6
 - b. DC Resistance Unbalance, maximum: 5%
 - c. DC Resistance, maximum: 9.38 ohms / 100 meters
 - d. Mutual Capacitance: 5.6 nF / 100 meters at 1kHz
 - e. Nominal Velocity of Propagation (NVP): 68%
 - f. Operating Frequency, minimum: 250 MHz
 - g. Operating Voltage, maximum: 80 V
 - h. Transmission Standards: ANSI/TIA-568-C.2
 - i. Safety Voltage Rating: 300V
 - j. Dielectric Strength, minimum: 1500VAC; 2500VDC
3. Construction:
 - a. Jacket Material: PVC
 - b. Conductor Material: bare copper
 - c. Insulation Material: polyolefin
 - d. Separator Material: polyolefin
 - e. Shield Material: aluminum/poly
4. Environmental Specifications:
 - a. Environmental Space: non-plenum
 - b. Flame Test Method: CMR
 - c. Operating Temperature: -20 degrees C to +60 degrees C
 - d. Installation Temperature: 0 degrees C to +60 degrees C

5. Mechanical Specifications:
 - a. Outer Jacket Diameter: 0.285 inches
 - b. Jacket Thickness: 0.020 inches
 - c. Pulling Tension: 25 lbs

2.04 ONE-PAIR SHIELDED AUDIO CABLE

A. GENERAL:

1. One-pair Audio Cable to be Belden 9316, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: shielded, 100%
- b. Number of Pairs: 1
- c. Conductor Gage: 16 AWG
- d. Conductor Type: stranded 19x29
- e. Pair Colors:

- 1) Red conductor/Black conductor

- f. Drain Wire: tinned copper, 19x30 stranded, 18AWG

2. Electrical Specifications:

- a. Inductance, nominal: 0.16 uH/ft (0.52496 uH/m)
- b. Capacitance, conductor to conductor, nominal: 68 pF/ft (223.108 pF/m)
- c. Capacitance, conductor to other conductor and shield, nominal: 121 pF/ft (397.001 pF/m)
- d. Conductor DC Resistance at 20 degrees C, nominal: 4.2 ohms/1000ft (13.780 ohms/km)
- e. Shield DC Resistance at 20 degrees C, nominal: 5.70 ohms/1000ft (18.702 ohms/km)
- f. Operating voltage, maximum: 300 V RMS

3. Construction:

- a. Jacket Material: PVC, UV rated
- b. Conductor Material: tinned copper, 19x29 stranded
- c. Insulation Material: PVC
- d. Shield Material: aluminum foil-polyester tape

4. Environmental Specifications:
 - a. Environmental Space: non-plenum
 - b. Flame Test Method: UL 1685-FT4; IEEE 1202
 - c. Operating Temperature: -30 degrees C to +105 degrees C
5. Mechanical Specifications:
 - a. Outer Jacket Diameter: 0.256 inches
 - b. Jacket Thickness: 0.037 inches
 - c. Pulling Tension: 40 lbs

2.05 THREE-PAIR SHIELDED AUDIO CABLE

A. GENERAL:

1. Three-pair Audio Cable to be Belden 8777, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: shielded, 100%
- b. Number of Pairs: 3
- c. Conductor Gage: 22 AWG
- d. Conductor Type: stranded 7x30
- e. Pair Colors:
 - 1) Black / Red
 - 2) Black / White
 - 3) Black / Green
- f. Drain Wire: tinned copper, 7x30 stranded, 22 AWG

2. Electrical Specifications:

- a. Characteristic Impedance, nominal: 50 ohms
- b. Inductance, nominal: 0.18 uH/ft (0.59058 uH/m)
- c. Capacitance, conductor to conductor, nominal: 30 pF/ft (98.43 pF/m)
- d. Capacitance, conductor to other conductor and shield, nominal: 55 pF/ft (180.455 pF/m)
- e. Nominal Velocity of Propagation (NVP): 66%
- f. Conductor DC Resistance at 20 degrees C, nominal: 15.0 ohms/1000ft (49.215 ohms/km)
- g. Shield DC Resistance at 20 degrees C, nominal: 10.6 ohms/1000ft (34.779 ohms/km)
- h. Operating voltage, maximum: 300 V RMS

3. Construction:

- a. Jacket Material: PVC
- b. Conductor Material: tinned copper, 7x30 stranded
- c. Insulation Material: polypropylene
- d. Shield Material: aluminum foil – polyester tape

4. Environmental Specifications:

- a. Environmental Space: non-plenum
- b. Flame Test Method: UL 1685
- c. Operating Temperature: -20 degrees C to +80 degrees C

5. Mechanical Specifications:

- a. Outer Jacket Diameter: 0.273 inches
- b. Jacket Thickness: 0.034 inches
- c. Pulling Tension: 79 lbs

2.06 ONE-PAIR INSTRUMENTATION CABLE

A. GENERAL:

- 1. One-pair Audio Cable to be Belden 8208, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: shielded, 73%
- b. Number of Pairs: 1
- c. Conductor Gage: 18 AWG
- d. Conductor Type: stranded 16x30
- e. Pair Colors:
 - 1) Red conductor/White conductor
- f. Drain Wire: n/a

2. Electrical Specifications:

- a. Characteristic Impedance, nominal: 44 ohms
- b. Inductance, nominal: 0.20 uH/ft (0.6562 uH/m)
- c. Capacitance, conductor to conductor, nominal: 46 pF/ft (150.926 pF/m)
- d. Capacitance, conductor to other conductor and shield, nominal: 77 pF/ft (252.637 pF/m)
- e. Conductor DC Resistance at 20 degrees C, nominal: 6.5 ohms /1000ft (21.33 ohms/km)
- f. Operating voltage, maximum: 300 V RMS

3. Construction:

- a. Jacket Material: PVC
- b. Conductor Material: tinned copper, 16x30 stranded
- c. Insulation Material: rubber
- d. Separator Material: polyester tape
- e. Shield Material: tinned copper braid

4. Environmental Specifications:
 - a. Environmental Space: non-plenum
 - b. Operating Temperature: -20 degrees C to +80 degrees C
5. Mechanical Specifications:
 - a. Outer Jacket Diameter: 0.257 inches
 - b. Jacket Thickness: 0.025 inches
 - c. Pulling Tension: 69 lbs

2.07 TWENTY-FIVE (25)-PAIR CATEGORY 5E UTP OSP CABLE

A. GENERAL:

1. 25-pair Category 5e UTP OSP Cable to be Superior Essex 51-499-EL, or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: U/UTP (unshielded twisted pair)
- b. Number of Pairs: 25
- c. Conductor Gage: 24 AWG
- d. Conductor Type: solid annealed copper

2. Electrical Specifications:

- a. ANSI/TIA Category: Category 5e
- b. DC Resistance Unbalance, nominal: 3-5%
- c. DC Resistance, nominal: 9 ohms / 100 meters
- d. Mutual Capacitance: 3.0-6.0 nF / 100 meters at 1kHz
- e. Nominal Velocity of Propagation (NVP), nominal: 69%
- f. Operating Frequency, minimum: 200 MHz
- g. Transmission Standards: ANSI/TIA-568-C.2
- h. Safety Voltage Rating: 300V

3. Construction:

- a. Jacket Material: CM rated, non-halogen OSP grade
- b. Conductor Material: solid annealed copper
- c. Insulation Material: thermoplastic
- d. Separator Material: cylindrical, flame retardant thermoplastic
- e. Flooding Compound: gel-filled or water block tape

4. Environmental Specifications:

- a. Environmental Space: outdoor; direct buried, aerial, conduit
- b. Operating Temperature: -40 degrees C to +60 degrees C
- c. Installation Temperature: -20 degrees C to +60 degrees C

5. Mechanical Specifications:
 - a. Outer Jacket Diameter: 0.59 inches, nominal

PART 3 EXECUTION

3.01 GENERAL

- A. All installation to be done in conformance with ANSI/TIA/EIA-568-C standards, BICSI methods, industry standards and manufacturer's installation guidelines.
- B. The Contractor to ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities.
- C. Failure to follow the appropriate guidelines to require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This to also apply to any and all damages sustained to the cables by the Contractor during the implementation.
- D. In the Communications Room, cables to be combed and dressed with Velcro ties in a manner as to prevent twists, "braiding" and crossed cables in the cable bundle from the Communications Room entrance to the respective termination point. Behind patch panels, the cable bundle to be attached to the rear cable support bar, and to drop out each cable in a neat, cascading manner to prevent crossed and/or interwoven cables to each patch panel port termination point.

3.02 HORIZONTAL CABLING INSTALLATION

- A. The Contractor to install Communications Copper Horizontal Cabling as required below:
 1. Install all cabling following telecommunications industry best practices, techniques, and methods that are consistent with specified data cabling and manufacturer recommendations.
 2. Install cabling in continuous lengths from station communications device outlet or demarcation point to specified patch panels and/or termination blocks.
 3. Terminate horizontal cabling onto modular jacks, patch panels, or termination blocks without damaging twisted pairs or jacket.
 4. Pull cabling in smooth and regular motions in methods to prevent cable kinking.
 5. If necessary use approved cable pulling lubricant.
 6. Keep all cabling jacks, terminal contacts, and patch panels protected before and after installation with dust and moisture proof barrier materials. If wiring is terminated on patch panels, data, voice jacks prior to painting and general finish clean up, the jacks to be protected to ensure dust, debris, moisture, and other foreign material do not settle onto jack or terminal contacts. It to be the Contractor's responsibility to ensure the integrity of these protective measures throughout the life/installation of the project.
 7. Do not bind cabling tightly together with tie-wraps or other cable ties. Wraps to slip loosely around cables. Use Velcro wraps instead of cable ties for all bundling in the Communications Room and Hubs.
 8. Pull cabling simultaneously if more than one is being installed in the same raceway/pathway.
 9. Use pulling means, including but not limited to fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.

10. Install open cabling parallel and perpendicular to surfaces or structural members following surface contours where possible.
11. Do not bend cable greater than a bend radius of 1.00 inch.
12. Cable bundles brought into the Communications Room to be routed and dressed in such a manner that prior to termination, the cables are not subject to damage and misuse such as installers walking on the bundles that are lying on the floor. Cable pulling force to not exceed 25 pounds of pulling tension or cable manufacturer's recommended pulling tensions.
13. Group all cabling, such as CCTV, DMS, Telephone, PA, Network, etc., with their respective groups, clearly labeled as to cable number and function, in the last positions on the horizontal cabling blocks in each Communications Room and Hubs.

3.03 IDENTIFICATION

A. The Contractor to:

1. Label cable terminations on designation strips.
2. Label all cable at each terminating point.
3. Label each port of the work area outlet.
4. Cable identification numbers to not be duplicated.
5. Labeling convention to be coordinated with IDOT and the CTA.
6. Label data patch panels and termination blocks in the Communications Room and Hubs to match those on the corresponding voice and data outlets. The font to be at least .125-inch in height.
7. All labels to correspond to as-built drawings and to final test reports.
8. Post the cable schedule in a prominent location in the Communications Room and each Hub. List incoming and outgoing cables and their designations, origins, and destinations.
9. Provide electronic copy of final comprehensive schedules for project in Microsoft Excel format.

3.04 HORIZONTAL CABLING TESTING

- A. Contractor to test each cable prior to acceptance.
- B. Contractor to supply all of the required test equipment used to conduct acceptance tests.
- C. Contractor to submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.
- D. Standards Compliance and Test Requirements:
 1. Copper Cabling to meet ANSI/TIA-568-C.2 Horizontal cabling requirements.
- E. Cable test documentation to be submitted in hard copy and electronic formats. If proprietary software is used, disk or CD to contain any necessary software application required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc., software to read these files is not required. Electronic reports to be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate to reference traceable circuit numbers that match the electronic record.
- F. Copper: Test reports to include the following information for each cabling element:

1. Wire map results that indicate that 100% of the cabling has been tested for shorts, opens, miss-wires, splits, polarity reversals, transpositions, presence of AC voltage and end-to-end connectivity.
2. Length, propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification to be marked as a FAIL.
3. For Category 6 cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests to be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information to be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification to be marked as a FAIL. Test to also include mutual capacitance and characteristic impedance.
4. Cable manufacturer, cable model number/type, and NVP.
5. Test equipment manufacturer, model, serial number, hardware version, software version and calibration certification.
6. Cable ID and project name
7. Date of test.

END OF SECTION 27 15 13

SECTION 27 15 23
COMMUNICATIONS FIBER OPTIC HORIZONTAL CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing COMMUNICATIONS FIBER OPTIC HORIZONTAL CABLING at the locations as shown on the Contract Drawings.
- B. Provide all horizontal fiber optic cabling, terminations, patch panels, and cross-connection materials as required to interconnect all communication systems between station communication devices and locations including but not limited to:
1. Main Station Communications Room
 2. Station Communications Hub
 3. East Station Communications Hub
 4. West Platform Communications Hub
- C. Communications Horizontal Fiber Optic Cabling for this rail station to include the following types of cables and associated station communication devices:
1. Two-strand multimode zip cord fiber optic drop cable
 - a. Station Area CA Kiosks
 - b. Station Area AFC End Cabinets
 - c. Equipment Rooms
 - d. Elevator Machine Rooms
 2. Six-strand multimode fiber optic interconnect cable
 - a. Main Station AFC End Cabinet
 - b. Center Station AFC HBG End Cabinet
 - c. South Station AFC HBG End Cabinet
 3. Twelve-strand pre-terminated multimode fiber optic cable
 - a. Communication Hubs / Room
- D. The Twelve-strand Pre-terminated Multimode Fiber Optic Cable to be a factory manufactured cable system of loose tube outdoor rated fiber optic cables with a multi-fiber, single connection at each end of the cable segments. Each pre-terminated end to be a mass 12-fiber MT female optical connector in a sealed environmental mating mechanical connector. The 12-fiber MT female connector to interface to a corresponding 12-fiber MT male connector harness within a factory pre-connectorized SC optical connector housing.
1. The pre-terminated multimode cable system to allow end-to-end cable installation and optical commissioning without onsite fiber strand splicing or onsite fiber strand connectorization.

2. The pre-terminated multimode cable system to extend between each Communications Hub and adjacent Communications Hubs or Room, creating a physical 12-strand cable ring:
 - a. From the Main Station Communications Room
 - b. To Center Station Communications Hub
 - c. To South Station Communications Hub
 - d. To South Platform Communications Hub
 - e. To North Platform Communications Hub
 - f. And back to Main Station Communications Room

1.03 RELATED WORK

- A. COMMUNICATIONS FIBER OPTIC HORIZONTAL CABLING specified to be furnished and installed herein have related work in various other sections, including, but not limited to:

1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.

1. AFC – Automated Fare Control
2. ANSI – American National Standards Institute
3. BICSI – Building Industry Consulting Services International
4. EIA – Electronics Industry Association
5. HBG – High Barrier Gate turnstile
6. IEEE – Institute of Electrical and Electronics Commissioners
7. IDF – Intermediate Distribution Frame
8. OSP – Outside Plant Cable
9. TIA – Telecommunications Industry Association
10. UL – Underwriters Laboratories

- B. Publications.

1. None.

- C. Reference Standards.

1. NEC Article 770 OFNR
2. ISO / IEC 11801 Generic Cabling for Customer Premises
3. ANSI/TIA-568-C Commercial Building Telecommunications Wiring Standard
4. ANSI/TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
5. ANSI/TIA-606-A Administration Standard for Commercial Telecommunications Infrastructure
6. ANSI/TIA-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
7. ANSI/TIA-758-A Customer-Owned Outside Plant Telecommunications Infrastructure Standard
8. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM), current edition

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 TWO-STRAND MULTIMODE ZIPCORD FIBER OPTIC DROP CABLE

A. GENERAL:

- 1. Two-strand Multimode Fiber Optic Drop Cable to be Corning Cable Systems 002T51-31131-24 or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: tight buffered zip cord
- b. Fiber Count (number of strands): 2
- c. Fiber Category: 50 um multimode (OM2)

2. Optical Specifications:

- a. Fiber Type: multimode
- b. Fiber Core Diameter: 50 um
- c. Fiber Cladding Diameter: 125 um
- d. Tight Buffered Fiber Diameter: 900 um
- e. Fiber Category: OM2
- f. Wavelengths: 850 nm / 1300 nm
- g. Maximum Attenuation: 2.8 dB/km at 850 nm / 1.0 dB/km at 1300 nm
- h. Minimum Overfilled Launch (OFL) Bandwidth: 700 MHz*km at 850 nm / 500 MHz*km at 1300 nm
- i. Minimum Effective Modal Bandwidth (EMB): 950 MHz*km at 850 nm / n/a at 1300 nm
- j. Serial 1 Gigabit Ethernet: 750 m at 850 nm / 600 m at 1300 nm
- k. Serial 10 Gigabit Ethernet: 150 m at 850 nm / n/a at 1300 nm

3. Construction:
 - a. Outer Jacket Material: flame-retardant
 - b. Outer Jacket Color: orange
 - c. Number of Subunits: 2
 - d. Tensile Strength Element: dielectric strength member
 - e. Tight Buffer Color: blue, white
4. Environmental Specifications:
 - a. Environmental Space: indoor, non-plenum
 - b. Flame Rating: riser (OFNR)
 - c. Operating Temperature: -20 degrees C to +70 degrees C
 - d. Storage Temperature: -40 degrees C to +70 degrees C
5. Mechanical Specifications:
 - a. Single Tube Diameter, nominal: 0.11 inches (2.8mm)
 - b. Outer Jacket Diameter, nominal: 0.11 inches x 0.22 inches (2.8mm x 5.6mm)
 - c. Minimum Bend Radius, Installation: 2 inches
 - d. Minimum Bend Radius, Operation: 0.55 inches
 - e. Short-term Tensile Strength, maximum: 50lbf (220N)
 - f. Long-term Tensile Strength, maximum: 15lbf (66N)

2.02 TWELVE-STRAND PRE-TERMINATED MULTIMODE FIBER OPTIC CABLE

A. GENERAL:

1. Twelve-strand Pre-terminated Multimode Fiber Optic Cable to be Corning Cable Systems Opti-Tip M3M312TB4D1E500F-P or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Pre-terminated cable segments to be available in the following lengths:
 - 1) 100 feet
 - 2) 250 feet
 - 3) 500 feet
 - 4) 1,000 feet
- b. Cable Type: single loose tube, factory pre-terminated
- c. Connection Type: mass fiber MT female optical connector with environmentally sealed threaded connector
- d. Fiber Count (number of strands): 12
- e. Fiber Category: 50 um multimode (OM3)
- f. Fiber Colors: blue, orange, green, brown, slate, white, red, black, yellow, violet, rose, aqua

2. Optical Specifications:

- a. Fiber Type: multimode
- b. Fiber Core Diameter: 50 um
- c. Fiber Cladding Diameter: 125 um

- d. Fiber Category: OM3
- e. Wavelengths: 850 nm / 1300 nm
- f. Maximum Attenuation: 3.0 dB/km at 850 nm / 1.0 dB/km at 1300 nm
- g. Minimum Overfilled Launch (OFL) Bandwidth: 1500 MHz*km at 850 nm / 500 MHz*km at 1300 nm
- h. Minimum Effective Modal Bandwidth (EMB): 2000 MHz*km at 850 nm / n/a at 1300 nm
- i. Serial 1 Gigabit Ethernet: 1000 m at 850 nm / 600 m at 1300 nm
- j. Serial 10 Gigabit Ethernet: 300 m at 850 nm / n/a at 1300 nm

3. Cable Connection Specifications:

- a. Cable Connector: mass fiber MT female optical connector, 12 strand
- b. Cable Connector Length: 3.47 inches, female tip to end of boot; 3.29 inches male tip to end of boot; 6.72 inches, female-male mated pair
- c. Cable Connector Outer Diameter: 0.7 inches
- d. Mateability: pinned alignment, male to female connector;
- e. Standards: EIA/TIA 568-B.3; GR-3152; IP-69K; IP-68
- f. Tensile Strength: 100 lbf
- g. Insertion Loss: 0.65dB maximum per fiber, 0.35dB nominal
- h. Reflectance: ≤ -20 dB
- i. Durability: <0.3 dB change over 200 rematings, FOTP-21

4. Construction:

- a. Outer Jacket Material: polyethylene
- b. Outer Jacket Color: black
- c. Number of Subunits: 1
- d. Tensile Strength Element: dielectric strength member
- e. Water Block: water-swellable fiberglass
- f. Tube Filling Compound: gel-filled

5. Environmental Specifications:

- a. Environmental Space: outdoor
- b. Application: self-supporting, duct
- c. Operating Temperature: -40 degrees C to +70 degrees C
- d. Installation Temperature: -30 degrees C to +70 degrees C
- e. Storage Temperature: -40 degrees C to +70 degrees C

6. Mechanical Specifications:
 - a. Outer Jacket Diameter, nominal: 0.32 inches x 17 inches (8.1mm x 4.5mm)
 - b. Buffer Tube Diameter: 0.12 inches (3mm)
 - c. Minimum Bend Radius: 3.15 inches
 - d. Short-Term Tensile Strength, maximum: 300 lbf (1350 N)
 - e. Long-Term Tensile Strength, maximum: 90 lbf (400 N)
 - f. Crush Strength, maximum: 125 lbf/in (220 N/cm)

C. CONNECTOR REQUIREMENTS

1. Communications Hub Connector Panel to be Corning SPH-12OTS- 12E7H, or Commissioner approved equivalent:
 - a. 12-fiber capacity single panel wall mountable housing
 - b. Construction: black, metal housing; hinged access panel
 - c. Dimensions: 6.5 inches H x 6.0 inches W x 1.5 inches D
 - d. Premises Connectors:
 - 1) Six SC-type duplex adapters, 50um multimode, OM3
 - 2) Standards: EIA/TIA 568-B.3; FOCIS-TIA/EIA-604-3
 - 3) Tensile Strength: ≤ 0.2 dB change, 15lbf; FOTP-6
 - 4) Insertion Loss: 0.5dB maximum per fiber, 0.2dB nominal
 - 5) Reflectance: ≤ -20 dB
 - 6) Durability: < 0.2 dB change over 500 rematings, FOTP-21
 - e. Field Cable Connector:
 - 1) One integrated mass fiber MT male optical connector, 12 strand; internal harness to SC adapters
 - 2) Field Cable Mateability: pinned alignment
 - 3) Standards: EIA/TIA 568-B.3; GR-3152; IP-69K; IP-68
 - 4) Tensile Strength: 100 lbf
 - 5) Insertion Loss: 0.65dB maximum per fiber, 0.35dB nominal
 - 6) Reflectance: ≤ -20 dB
 - 7) Durability: < 0.3 dB change over 200 rematings, FOTP-21
2. Communications Room Connector Panel to be Corning CC1-24OTS- 24E7H, or Commissioner approved equivalent:
 - a. 24-fiber capacity 1U panel rack mountable housing
 - b. Construction: black, metal housing
 - c. Dimensions: 1.75 inches H x 17.9 inches W x 9.7 inches D
 - d. Premises Connectors:
 - 1) Twelve SC-type duplex adapters, 50um multimode, OM3
 - 2) Standards: EIA/TIA 568-B.3; FOCIS-TIA/EIA-604-3
 - 3) Tensile Strength: ≤ 0.2 dB change, 15lbf; FOTP-6
 - 4) Insertion Loss: 0.5dB maximum per fiber, 0.2dB nominal
 - 5) Reflectance: ≤ -20 dB
 - 6) Durability: < 0.2 dB change over 500 rematings, FOTP-21

- e. Field Cable Connector:
 - 1) Two integrated mass fiber MT male optical connectors, 12 strand; internal harness to SC adapters
 - 2) Field Cable Mateability: pinned alignment
 - 3) Standards: EIA/TIA 568-B.3; GR-3152; IP-69K; IP-68
 - 4) Tensile Strength: 100 lbf
 - 5) Insertion Loss: 0.65dB maximum per fiber, 0.35dB nominal
 - 6) Reflectance: ≤ -20 dB
 - 7) Durability: <0.3 dB change over 200 rematings, FOTP-21

2.03 SIX-STRAND MULTIMODE FIBER OPTIC INTERCONNECT CABLE

A. GENERAL:

- 1. Six-strand Multimode Fiber Optic Interconnect Cable to be Corning Cable Systems FREEDM One 006T8F-31131-29 or Commissioner approved equivalent.

B. CABLE REQUIREMENTS

1. General Specifications:

- a. Cable Type: tight buffered
- b. Fiber Count (number of strands): 6
- c. Fiber Category: 50 μ m multimode (OM2)

2. Optical Specifications:

- a. Fiber Type: multimode
- b. Fiber Core Diameter: 50 μ m
- c. Fiber Cladding Diameter: 125 μ m
- d. Tight Buffered Fiber Diameter: 900 μ m
- e. Fiber Category: OM2
- f. Wavelengths: 850 nm / 1300 nm
- g. Maximum Attenuation: 3.0 dB/km at 850 nm / 1.0 dB/km at 1300 nm
- h. Minimum Overfilled Launch (OFL) Bandwidth: 700 MHz*km at 850 nm / 500 MHz*km at 1300 nm
- i. Minimum Effective Modal Bandwidth (EMB): 950 MHz*km at 850 nm / n/a at 1300 nm
- j. Serial 1 Gigabit Ethernet: 750 m at 850 nm / 600 m at 1300 nm
- k. Serial 10 Gigabit Ethernet: 150 m at 850 nm / n/a at 1300 nm

3. Construction:

- a. Outer Jacket Material: flame-retardant, UV resistant
- b. Outer Jacket Color: black
- c. Number of Subunits: 6
- d. Tensile Strength Element: water-swellable strength member
- e. Tight Buffer Color: blue, white

4. Environmental Specifications:
 - a. Environmental Space: indoor/outdoor
 - b. Application: aerial, direct-buried, duct
 - c. Flame Rating: riser (OFNR)
 - d. Operating Temperature: -40 degrees C to +70 degrees C
 - e. Installation Temperature: -10 degrees C to +60 degrees C
 - f. Storage Temperature: -40 degrees C to +70 degrees C
5. Mechanical Specifications:
 - a. Outer Jacket Diameter, nominal: 0.22 inches (5.6mm)
 - b. Minimum Bend Radius, Installation: 3.2 inches
 - c. Minimum Bend Radius, Operation: 1.1 inches
 - d. Short-term Tensile Strength, maximum: 150 lbf (675N)
 - e. Long-term Tensile Strength, maximum: 45 lbf (200N)

PART 3 EXECUTION

3.01 GENERAL

- A. All installation to be done in conformance with ANSI/TIA/EIA-568-C standards, BICSI methods, industry standards and manufacturer's installation guidelines.
- B. The Contractor to ensure that the maximum pulling tensions of the specified cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities.
- C. Failure to follow the appropriate guidelines to require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This to also apply to any and all damages sustained to the cables by the Contractor during the implementation.
- D. In the Communications Room, cables to be combed and dressed with Velcro ties in a manner as to prevent twists, "braiding" and crossed cables in the cable bundle from the Communications Room entrance to the respective termination point. Behind patch panels, the cable bundle to be attached to the rear cable support bar, and to drop out each cable in a neat, cascading manner to prevent crossed and/or interwoven cables to each patch panel port termination point.

3.02 HORIZONTAL CABLING INSTALLATION

- A. The Contractor to install Communications Fiber Optic Horizontal Cabling as required below:
 1. Install all cabling following telecommunications industry best practices, techniques, and methods that are consistent with specified data cabling and manufacturer recommendations.
 2. Install cabling in continuous lengths from station communications device outlet or demarcation point to specified termination panels.
 3. Terminate horizontal cabling onto termination panels without damaging fiber strands or jacket.
 4. Pull cabling in smooth and regular motions in methods to prevent cable kinking.
 5. If necessary use approved cable pulling lubricant.
 6. Keep all cabling termination connectors and patch panels protected before and after installation with dust and moisture proof barrier materials. If cabling is

terminated on patch panels prior to painting and general finish clean up, the connectors to be protected to ensure dust, debris, moisture, and other foreign material do not settle into the connectors. It to be the Contractor's responsibility to ensure the integrity of these protective measures throughout the life/installation of the project.

7. Do not bind cabling tightly together with tie-wraps or other cable ties. Wraps to slip loosely around cables. Use Velcro wraps instead of cable ties for all bundling in the Communications Room and Hubs.
8. Pull cabling simultaneously if more than one is being installed in the same raceway/pathway.
9. Use pulling means, including but not limited to fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
10. Install open cabling parallel and perpendicular to surfaces or structural members following surface contours where possible.
11. Do not bend cable greater than a bend radius of 1.00 inch.
12. Cable bundles brought into the Communications Room to be routed and dressed in such a manner that prior to termination, the cables are not subject to damage and misuse such as installers walking on the bundles that are lying on the floor. Cable pulling force to not exceed 25 pounds of pulling tension or cable manufacturer's recommended pulling tensions.
13. Group all cabling, such as CCTV, DMS, Telephone, PA, Network, etc., with their respective groups, clearly labeled as to cable number and function, in the last positions on the horizontal cabling blocks in each Communications Room and Hubs.

3.03 IDENTIFICATION

A. The Contractor to:

1. Label cable terminations on designation strips.
2. Label all cable at each terminating point.
3. Label each port of the work area outlet.
4. Cable identification numbers to not be duplicated.
5. Labeling convention to be coordinated with IDOT and the CTA.
6. Label fiber patch panels in the Communications Room and Hubs to match those on the corresponding fiber outlets. The font to be at least .125-inch in height.
7. All labels to correspond to as-built drawings and to final test reports.
8. Post the cable schedule in a prominent location in the Communications Room and each Hub. List incoming and outgoing cables and their designations, origins, and destinations.
9. Provide electronic copy of final comprehensive schedules for project in Microsoft Excel format.

3.04 HORIZONTAL CABLING TESTING

- A. Contractor to test each cable prior to acceptance.
- B. Contractor to supply all of the required test equipment used to conduct acceptance tests.
- C. Contractor to submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.
- D. Standards Compliance and Test Requirements:

1. Optical Cabling to meet ANSI/TIA-568-C.2 Horizontal cabling requirements.

- E. Cable test documentation to be submitted in hard copy and electronic formats. If proprietary software is used, disk or CD to contain any necessary software application required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc., software to read these files is not required. Electronic reports to be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate to reference traceable circuit numbers that match the electronic record.

- F. Optical Test reports to include the following information for each cabling element:
 - 1. Power Meter and Source Loss Reports: Testing to consist of a bi-directional, dual wave length end to end test. The system loss measurements to be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.
 - 2. Optical Time Domain Reflectometer (OTDR) Reports: Testing to consist of a bi-directional end to end OTDR trace performed per TIA/EIA 455-61. The system loss measurements to be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.

END OF SECTION 27 15 23

SECTION 27 32 13
TELEPHONE SETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing TELEPHONE SETS at the locations as shown on the Contract Drawings.
- B. General: The work of this Section consists of furnishing and installing telephones, and the necessary work and materials to interface the telephones to the CTA PBX System. The following functional areas to receive the specified telephone type:
1. Station Equipment Rooms – Type 1 Telephone
 2. Station Platforms – Type 2 Telephone
 3. Customer Assistant Kiosks – Type 3 Telephone
 4. Help Point Telephones / Customer Assistance (specified elsewhere) – Type 4 Telephone
 5. Elevators (specified elsewhere) – Type 7 Telephone
- C. Existing CTA Telephone System: The CTA operates an existing Avaya PBX Voice Network. Refer to Specification 27 31 13 – PBX Systems for more information.
- D. Telephone Extension Numbers are presented in the Contract Drawings. The Contractor to coordinate with the CTA to confirm final telephone extension number assignments to all telephones covered under this Contract.

1.03 RELATED WORK

- A. TELEPHONE SETS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 “Communications General Provisions”
 2. Section 27 05 26 “Grounding and Bonding For Communication Systems”
 3. Section 27 31 13 “PBX Systems”
 4. Section 27 32 23 “Elevator Telephones”
 5. Section 27 32 26 “Help Point Telephones”

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. DTMF – Dual Tone Multi Frequency
 2. PBX – Private Branch Exchange
- B. Publications.
1. None.
- C. Reference Standards.

1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 TYPE 1 TELEPHONE – EQUIPMENT ROOM TELEPHONE

A. GENERAL:

1. Type 1 Telephones to be Cortelco model 2554-20M or Engineer approved equivalent.

B. PHYSICAL:

1. Traditional Bell standard 2554
2. Wall mount
3. High impact plastic housing and handset
4. Metal baseplate
5. Color: Black
6. Single gong ringer
7. Fully modular
8. Ringer volume control
9. ADA compliant variable volume control on handset
10. 9 foot handset cord
11. 12 button: 0-9, #, *

C. ELECTRICAL:

1. Analog operation
2. Polarity guarded DTMF dial
3. RJ-11 modular jack, wall-plate capable
4. A-lead compatible

5. multi-contact hookswitch

D. MECHANICAL:

1. Indoor rated operation

2.02 TYPE 2 TELEPHONE - OUTDOOR TELEPHONE

A. GENERAL:

1. Type 2 Telephones to be Gaitronics model 226-005 or Engineer approved equivalent.

B. PHYSICAL:

1. The Type 2 Telephone to be a rugged outdoor weatherproof telephone, for use in areas subjected to extended temperature ranges, high-intensity vandalism, and abuse
2. Thick walled cast aluminum, vandal-resistant heavy duty housing
3. Protected concealed hinges
4. Spring return door
5. Sealed, heavy duty, marine quality keypad, 12 button: 0-9, #, *
6. Sealed front panel to prevent entry of contaminants
7. Extra heavy duty, sealed proximity detecting, marine quality hookswitch
8. Extra heavy duty handset with sealed transmitter and receiver caps
9. G-style 19 inch lanyard embedded armored cord with eight-hundred (800) lb. pull strength
10. Hearing aid compatible receiver
11. Dual-tone electronic ringer
12. Field selectable DTMF (tone) or pulse dialing
13. Surface or pole mount
14. Color: Gray
15. UL Listed

C. ELECTRICAL:

1. Operation: Analog, loop start
2. Minimum loop current (at48VDC): 24mA
3. Polarity guarded DTMF dial
4. RJ-11 modular jack within enclosure
5. A-lead compatible
6. Telephone line powered
7. Noise cancelling microphone
8. 4 step volume control: -6dB, 0 dB, 6 dB, 12 dB
9. Dual isolated solid state control outputs: 48VDC at125mA; 28 Vrmsat80mArms
10. Non-volatile EEPROM memory

D. MECHANICAL:

1. Outdoor rated operation
2. Temperature: -20 degrees C to +60 degrees C
3. Humidity: 95% max, no condensation
4. Size: 13.50 inches H x 9.70 inches W x 6.15 inches D
5. Weight: 14.5 lbs

E. FEATURES

1. Self Monitoring and Reporting Technology
2. Interfaces to Telephone Management Application monitoring software via a central computer
3. Remote programming
4. Remote health status reporting
5. Programmable Polling
6. Email notification of faults or reports
7. Report Data:
 - a. Call Type
 - b. Call Direction
 - c. Call Date, Time, Duration
 - d. Answer Delay
 - e. Termination Reason
 - f. Stuck Contacts
 - g. Phone Line Interruption
 - h. Micro-processor Self Test

2.03 TYPE 3 TELEPHONE – CUSTOMER ATTENDANT KIOSK TELEPHONE

A. GENERAL:

1. Type 3 Telephones to be Cortelco model 2500-20M or Engineer approved equivalent.

B. PHYSICAL:

1. Traditional Bell standard 2500
2. Desk mount
3. High impact plastic housing and handset
4. Metal baseplate
5. Color: Red
6. Double gong ringer
7. Fully modular
8. Ringer volume control
9. ADA compliant variable volume control on handset
10. 9 foot handset cord
11. 7 foot line cord
12. 12 button: 0-9, #, *

C. ELECTRICAL:

1. Analog operation
2. Polarity guarded DTMF dial
3. RJ-11 modular jack, wall-plate capable
4. A-lead compatible
5. multi-contact hookswitch

D. MECHANICAL:

1. Indoor rated operation

2.04 TYPE 4 TELEPHONE - HELP POINT TELEPHONE (CUSTOMER ASSISTANCE)

- A. Refer to Specification 27 32 26 – Help Point Telephones

2.05 TYPE 7 TELEPHONE - ELEVATOR TELEPHONE

- A. Refer to Specification 14 21 00 – Electric Traction Elevators

2.06 TELEPHONE SET CABLE

- A. Provide telephone cables as follows:

1. 4-pair, unshielded twisted pair (UTP), Category-6 standard, 22AWG, polyethylene jacket, outdoor rated.

2.07 SUPPORT EQUIPMENT

- A. In addition to the instruments specifically required to be installed per these Specifications and Drawings, the Contractor to furnish five percent (5%), of each type (minimum of one), beyond those required. These instruments to be furnished complete with housings, enclosures, protectors, and pedestals. All support equipment is to be delivered at a location designated by CDOT and the CTA.

2.08 PBX INTERFACE

- A. Refer to Specification 27 31 13 – PBX Systems for requirements to interface telephone sets provided under this section with the existing PBX voice network.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to provide all equipment, hardware, accessories, terminal blocks, protector blocks, cabinets, conduits, raceways, cable trays, and wire required for completion of the installation of the telephone instruments defined in this Section. In the Main Station Communications Room, the Contractor to make all necessary connections and cross-connections as required for interface to the fiber optic backbone; including cross connections to the primary switching equipment at the Control Center or other host node. Installation of all telephones to be in accordance with approved Contractor Drawings and consistent with industry standard telephone practices. Installation of all telephones to be consistent from site to site to provide uniformity in telephone installations.

1. Telephone Instrument Installation: Each telephone instrument to have at minimum, a dedicated Category-6 four-pair UTP cable from the telephone location to the assigned termination block in the respective Communications Hub and/or on the wall field block in the Communications Room.
2. Telephone instruments installed on the platform levels to be Type 2 Telephones with a two pair protector block, as specified elsewhere, mounted within.
3. All telephone types to terminate on a protected block in the Communications Room.

4. Communication Room Installation:
 - a. All telephone instruments, connecting blocks, and terminals to be labeled with extension numbers.
 - b. Following completion of the installation of all telephones, the Contractor to inspect all equipment and wiring to verify that all mechanical connections are made and properly secured, all hardware is installed in its proper location and is properly terminated. This inspection to include conductor and shield continuity and isolation verification of all installation wiring. This testing to be accomplished from the wallfield in the Communications Room as well as testing from any local termination in the vicinity of an instrument. Data sheets containing evidence of such inspection, certified as correct by the Contractor's Quality Control Engineer for the project, to be delivered to the CTA for approval. The Contractor to request from and to receive approval of such inspection certification before proceeding with further testing.
5. Install in accordance with the Manufacturer's recommended installation procedures, approved Shop Drawings, and in the locations indicated on the Contract Drawings for telephones as follows:
 - a. Single line 2500 telephone desk sets, Type 3, to be installed in all Kiosks.
 - b. Single line 2554 telephone wall sets, Type 1, to be installed in all, unless otherwise noted:
 - 1) Communications Rooms
 - 2) Electrical Rooms
 - 3) Mechanical Rooms
 - 4) Elevator Machine Rooms
 - c. Lock-Box Telephones, Type V, to be installed at, unless otherwise noted:
 - 1) The Fare Collection Array
6. All locations to be field verified by the Contractor, referenced to the Contract Drawings, and approved by the CTA.

3.02 GROUNDING

- A. Grounding will be provided for each unit installed in accordance with sections specified elsewhere.

3.03 LOCAL FIELD ACCEPTANCE TESTS

- A. Contractor to perform Local Field Acceptance Tests in accordance with the Manufacturer's approved test procedures, and furnish a report of each test to the CTA. As part of the Local Field Acceptance Test, the Contractor to check and verify continuity from each telephone location to the Frame Block in the Communication room.

3.04 PBX INTERFACE

- A. Refer to Specification 27 31 13 – PBX Systems for requirements to interface telephone sets provided under this section with the existing PBX voice network.

END OF SECTION 27 32 13

SECTION 27 32 26
HELP POINT TELEPHONE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing HELP POINT TELEPHONE at the locations as shown on the Contract Drawings.
- B. General: The work of this Section consists of furnishing and installing Help Point Telephones, and the necessary work and materials to interface the telephones to the CTA PBX System. The following functional areas to receive the specified telephone type:
1. Help Point Telephones / Customer Assistance – Type 4 Telephone
- C. Help Point Telephones replace the functionality of the traditional CA (customer assistance) pushbutton in addition to providing a direct two-way conversation capability between patrons in need of assistance and CTA personnel.
- D. The Type 4 Telephone to incorporate a one button, auto-dial function. The button to activate one to three an auto-dial programmable numbers. The large palm-size red button to be identified "HELP", with associated Braille markings, and to be programmed to dial the local Customer Assistant kiosk and then the CTA's Control Center if the kiosk does not answer. In addition, via the integral relays, the Help Point Telephone to trigger a local Blue Light into strobe flashing mode to indicate and locate an assistance call in progress and trigger a Public Address System audio and visual text message to broadcast a message that a customer needs assistance.
- E. The flush mount Type 4 Telephone to be installed in a custom designed cavity to accommodate the telephone unit on the exterior wall of each CA Kiosk, as shown on the Contract Drawings.
- F. The surface mount Type 4 Telephone to be installed on the platform canopy support plates as shown on the Contract Drawings. The Contractor to coordinate installation of the telephones and conduits with the Architectural plans. All conduit to be hidden, to the extent possible.
- G. Existing CTA Telephone System: The CTA operates an existing Avaya PBX Voice Network. Refer to Specification 27 31 13 – PBX Systems for more information.
- H. Telephone Extension Numbers are presented in the Contract Drawings. The Contractor to coordinate with the CTA to confirm final telephone extension number assignments to all telephones covered under this Contract

1.03 RELATED WORK

- A. TELEPHONE SETS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"
 2. Section 27 05 26 "Grounding and Bonding For Communication Systems"

- 3. Section 27 31 13 "PBX Systems"
- 4. Section 27 32 13 "Telephone Sets"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
 - 1. DTMF – Dual Tone Multi Frequency
 - 2. PBX – Private Branch Exchange
- B. Publications.
 - 1. None.
- C. Reference Standards.
 - 1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 TYPE 4 TELEPHONE - HELP POINT TELEPHONE (CUSTOMER ASSISTANCE)

- A. GENERAL:
 - 1. Type 4 Telephones to be provided in surface mount and flush mount designs.
 - 2. Surface mount Type 4 Telephones to be Gaitronics model 393AL-001 or Engineer approved equivalent.
 - 3. Flush mount Type 4 Telephones to be Gaitronics model 397-001 or Engineer approved equivalent.
- B. PHYSICAL:

1. The Type 4 Telephone to be a rugged outdoor weather resistant telephone, for use in areas subjected to extended temperature ranges, high-intensity vandalism, and abuse.
2. Thick walled cast aluminum enclosure for surface mount unit
3. Large palm size activation pushbutton for assistance
4. Sealed front panel to prevent entry of contaminants
5. Auto answer with silent monitoring
6. 2 programmable auxiliary relays outputs
7. LED light for call received indication
8. Dual-tone electronic ringer
9. Autodial programming, 3 number rollover
10. Field selectable DTMF (tone) or pulse dialing
11. Surface mount unit color: Epoxy Safety Yellow Finish
12. Flush mount unit color: Stainless Steel 14 gauge Type-304 brushed front panel; 16 gauge cold rolled steel, black back enclosure
13. ADA compliant
14. UL Listed

C. ELECTRICAL:

1. Operation: Analog; loop start, central office, or analog station port (PBX)
2. Minimum loop current (at48VDC): 24mA
3. DTMF signaling, 100ms tone
4. Audio output: 1 kHz tone at 87 +/- 3 dBspl at 1 meter with 40mA current
5. RJ-11 modular jack within enclosure
6. A-lead compatible
7. Telephone line powered
8. Noise cancelling microphone
9. 4 step volume control: -6dB, 0 dB, 6 dB, 12 dB
10. Dual isolated solid state control relay outputs: 48VDC at125mA; 28 Vrmsat80mArms
11. Non-volatile EEPROM memory

D. MECHANICAL:

1. Outdoor rated operation
2. Temperature: -20 degrees C to +60 degrees C
3. Humidity: 95% max, no condensation
4. Size:
 - a. Surface mount unit: 9.50 inches H x 8.0 inches W x 4.0 inches D
 - b. Flush mount unit: 12.0 inches H x 10.0 inches W front panel; 2.38 inches D back box
5. Weight:
 - a. Surface mount unit: 7.8 lbs
 - b. Flush mount unit: 6.5 lbs

E. FEATURES

1. Self Monitoring and Reporting Technology
2. Interfaces to Telephone Management Application monitoring software via a central computer
3. Remote programming
4. Remote health status reporting

5. Programmable Polling
6. Email notification of faults or reports
7. Report Data:
 - a. Line Integrity
 - b. Microprocessor Health
 - c. Stuck Buttons
 - d. Microphone Integrity
 - e. Speaker Integrity
 - f. Line Interrupt / Power Failure

2.02 BLUE LIGHT BEACON / STROBE

A. GENERAL:

1. Each Type 4 Telephone installation to include a Blue Light beacon / strobe in the general proximity of the Help Point Telephone. The Blue Light locations to be as shown on the Contract Drawings and to be coordinated with Architectural Plans.
2. The Blue Light is intended to visually identify a Help Point Telephone location from a reasonable distance for patrons to request assistance.
3. The Blue Light to be interfaced with the HPT via integrated relay within the HPT.
4. The Blue Light to provide a continuous illumination beacon function to aid in locating the HPT.
5. The Blue Light to provide a strobe or flashing illumination function to visually indicate a patron has requested assistance.
6. The Blue Light strobe to be automatically activated when the HPT help button is pressed, and to deactivate when the call is terminated.

B. PHYSICAL:

1. The Blue Light to be a low voltage LED based light source.
2. Light source: Single white LED; 347 lumens
3. Light output: 43 candela
4. LED life: 100,000 hour operation
5. Dome:
 - a. polycarbonate refractor
 - b. color: blue
 - c. prismatic design to distribute light in a horizontal pattern
 - d. weather and vandal resistant

C. ELECTRICAL:

1. Input voltage range: 10-28 VDC
2. Input voltage: 12VDC, 24VDC, nominal
3. 3 wire connection:
 - a. System On/Steady State: Red +VDC
 - b. Ground: Black -VDC
 - c. Flashing: White +VDC
4. Steady state mode:
 - a. 324mA at 10VDC
 - b. 273 mA at 12 VDC
 - c. 144 mA at 24 VDC
 - d. 125 mA at 28 VDC

5. Flashing Mode:

- a. 772 mA max / 2 mA min / 189 mA ave at10VDC
- b. 552 mA max / 2 mA min / 133 mA ave at12VDC
- c. 272 mA max / 3 mA min / 68 mA ave at24VDC
- d. 239 mA max / 3 mA min / 61 mA ave at28VDC

D. MECHANICAL:

- 1. NEMA 4X outdoor rated operation
- 2. Lighting element fully encapsulated in urethane material
- 3. Temperature: -40 degrees C to +65 degrees C
- 4. Size: 5.25 inches H x 5.5 inches Diameter
- 5. Weight: 2 lbs
- 6. ½ inch female pipe mount

E. FEATURES

- 1. Steady burn mode: light to be continuously active
- 2. Programmable flash modes:
 - a. Single flash – 60 flashes per minute
 - b. Single flash – 150 flashes per minute
 - c. Single flash – 375 flashes per minute
 - d. Double flash – 125 flashes per minute
 - e. Double flash – 250 flashes per minute
 - f. Multi flash – 75 flashes per minute
 - g. Multi flash – 150 flashes per minute

2.03 TELEPHONE SET CABLE

A. Provide telephone cables as follows:

- 1. 4-pair, unshielded twisted pair (UTP), Category-6 standard, 22AWG, polyethylene jacket, outdoor rated.

2.04 SUPPORT EQUIPMENT

- A. In addition to the instruments specifically required to be installed per these Specifications and Drawings, the Contractor to furnish five percent (5%), of each type (minimum of one), beyond those required. These instruments to be furnished complete with housings, enclosures, protectors, and pedestals. All support equipment is to be delivered at a location designated by IDOT and the CTA.

2.05 PBX INTERFACE

- A. Refer to Specification 27 31 13 – PBX Systems for requirements to interface telephone sets provided under this section with the existing PBX voice network.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor to provide all equipment, hardware, accessories, terminal blocks, protector blocks, cabinets, conduits, raceways, cable trays, and wire required for

completion of the installation of the telephone instruments defined in this Section. In the Main Station Communications Room, the Contractor to make all necessary connections and cross-connections as required for interface to the fiber optic backbone; including cross connections to the primary switching equipment at the Control Center or other host node. Installation of all telephones to be in accordance with approved Contractor Drawings and consistent with industry standard telephone practices. Installation of all telephones to be consistent from site to site to provide uniformity in telephone installations.

1. Telephone Instrument Installation: Each telephone instrument to have at minimum, a dedicated Category-6 four-pair UTP cable from the telephone location to the assigned termination block in the respective Communications Hub and/or on the wall field block in the Communications Room.
2. Telephone instruments installed on the platform levels to be Type 4 Telephones with a two pair protector block, as specified elsewhere, mounted within.
3. All telephone types to terminate on a protected block in the Communications Room.
4. Communication Room Installation:
 - a. All telephone instruments, connecting blocks, and terminals to be labeled with extension numbers.
 - b. Following completion of the installation of all telephones, the Contractor to inspect all equipment and wiring to verify that all mechanical connections are made and properly secured, all hardware is installed in its proper location and is properly terminated. This inspection to include conductor and shield continuity and isolation verification of all installation wiring. This testing to be accomplished from the wallfield in the Communications Room as well as testing from any local termination in the vicinity of an instrument. Data sheets containing evidence of such inspection, certified as correct by the Contractor's Quality Control Engineer for the project, to be delivered to the CTA for approval. The Contractor to request from and to receive approval of such inspection certification before proceeding with further testing.
5. Install in accordance with the Manufacturer's recommended installation procedures, approved Shop Drawings, and in the locations indicated on the Contract Drawings for telephones as follows:
 - a. Flush mount Type 4 Telephones to be installed within flush cavities within Kiosk exterior walls.
 - b. Surface mount Type 4 Telephones to be installed on the platform as shown on the Contract Drawings.
6. All locations to be field verified by the Contractor, referenced to the Contract Drawings, and approved by the CTA.

3.02 GROUNDING

- A. Grounding will be provided for each unit installed in accordance with sections specified elsewhere.

3.03 LOCAL FIELD ACCEPTANCE TESTS

- A. Contractor to perform Local Field Acceptance Tests in accordance with the Manufacturer's approved test procedures, and furnish a report of each test to the CTA. As part of the Local Field Acceptance Test, the Contractor to check and verify continuity from each telephone location to the Frame Block in the Communication Room.

3.04 PBX INTERFACE

- A. Refer to Specification 27 31 13 – PBX Systems for requirements to interface telephone sets provided under this section with the existing PBX voice network.

END OF SECTION 27 32 26

SECTION 27 42 16
DYNAMIC MESSAGE SIGN

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- B. This specification consists of furnishing and installing DYNAMIC MESSAGE SIGNS at the locations as shown on the Contract Drawings.
- C. The Dynamic Message Signs are part of the station's Public Address system. DMS provide visual text display of PA messages for the station patrons, including automated Train Tracker real-time train arrival information, customer assistance requests, and train arrival safety and courtesy messages, as well as emergency and routine transit information messages from the local CA and/or the CTA Control Center.
- D. The DMS to be an LCD based digital display with embedded computer, connected to the station's Local Area Network for connection to and control by the Public Address system.

1.03 RELATED WORK

- A. DYNAMIC MESSAGE SIGNS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. ADA – Americans with Disabilities Act
 2. CA – Customer Assistant
 3. DMS – Dynamic Message Sign
 4. IP – Internet Protocol
 5. LAN – Local area Network
 6. PA – Public Address
- B. Publications.
1. ADA – Americans with Disabilities Act
 2. ANSI/NFPA 130-2010, Fixed Guideway Transit Systems
- C. Reference Standards.
1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.
- B. For the DMS provided, submit the following:
 - 1. Manufacturer's specifications (catalog cut sheets)
 - 2. Factory Acceptance Test Procedures
 - 3. Factory Acceptance Test Reports - a certified copy for DMS, demonstrating successful completion of the factory acceptance tests and compliance with the specifications.
 - 4. A detailed schematic diagram showing PA system components with DMS and local area network.
 - 5. Local Field Acceptance Test Procedures for approval by the CTA.
- C. Local Field Acceptance Test Reports for each installation showing satisfactory operation and performance to meet specifications.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 DYNAMIC MESSAGE SIGN

A. GENERAL:

- 1. The Dynamic Message Sign to be GDS Displays G3800003, or Engineer approved equivalent.

B. PHYSICAL:

- 1. Display: LED backlit LCD panel
- 2. Display Area: 38" diagonal display
- 3. Aspect Ratio: 7:2
- 4. Resolution: 1920 x 502
- 5. Front window: 6mm anti-reflective, hardened glass
- 6. Brightness: 1000 cd/m²
- 7. LED backlight life: 50,000 hours
- 8. Remote Monitoring:
 - a. Screen activity
 - b. Performance
 - c. Internal temperature

- d. Fan performance
- e. Remote on/off
- f. Remote reset

C. ELECTRICAL:

- 1. Power Input: 110-240VAC, 50-60 Hz
- 2. Power Consumption: 300W maximum

D. MECHANICAL:

- 1. Environmental Space: outdoor rated operation, IP65
- 2. Thermal Management:
 - a. (4) airflow temperature monitoring sensors
 - b. (1) internal display sensor
 - c. (1) internal enclosure sensor
 - d. (2) air circulation sensors
- 3. Temperature: -5 degrees C to + 40 degrees C
- 4. Relative Humidity: 90%, non-condensing
- 5. Dimensions: 44" W x 19" H x 10" D
- 6. Weight: 91 lbs maximum
- 7. Color: Black

E. EMBEDDED COMPUTER

- 1. Processor: Intel i5 processor
- 2. Memory: 2GB DDR3 1066 Non-ECC DIMM
- 3. Motherboard: Mini ITX STD Base
- 4. Hard Drive: 8GB solid state drive
- 5. USB Ports: (4) USB 2.0
- 6. Ethernet Port: (2) RJ-45 100/1000Mbps
- 7. Video: Intel QM57 express chipset
- 8. LVDS: integrated LVDS panel drive
- 9. Serial Port: (2) D-sub RS-232
- 10. Operating System: Linux Ubuntu
- 11. Cooling Fan: CPU cooling fan

PART 3 EXECUTION

3.01 INSTALLATION

- A. The DMS to be installed at the locations as shown on the Contract Drawings.
- B. The DMS to be installed in accordance with the manufacturer's installation recommendations and industry best practices.
- C. The DMS network connection to be via Category-6 cable to the corresponding network switch in the Communications Room / Hub.

3.02 INSPECTION

- A. Following completion of the installation of all DMS equipment at the station, inspect equipment wiring to verify that all electrical and mechanical connections are made and properly secured, all hardware is installed in its proper location, and all wiring is properly

terminated. This inspection to include conductor and/or shield continuity and isolation verification of all installation wiring.

3.03 TESTING

A. Factory testing:

1. All DMS system equipment to be tested at the manufacturing location using the production inspection and testing procedures in normal use by the manufacturer. Provide test results of waterproof enclosure, as well as vibration and physical shock resistance of enclosure. Certification of the testing to be provided to the Engineer.

B. Installation Testing:

1. Test the DMS system equipment under electrical power following approval of the installation inspection by the Engineer. Installation testing to demonstrate the full functional capability of the equipment, and may involve the use of dummy content and other testing equipment and devices as temporary substitutes as long as the installation of the network throughout the station is incomplete.

C. System Testing:

1. Test each DMS in the station once installation is complete and the Engineer has approved the inspection certification. System testing to address at minimum:
 - a. Functional testing of each equipment item installed
 - b. Demonstration of visual messaging on DMS for automated messaging initiated locally and live and automated messaging initiated remotely from the CTA Control Center.

D. Integration Testing:

1. Integration testing of the complete PA System to follow completion of all contracted installation and system testing work, including station and Control Center based system tests. DMS to be part of the PA System Integration testing.

END OF SECTION 27 42 16

SECTION 27 51 17
PUBLIC ADDRESS SPEAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing PUBLIC ADDRESS SPEAKERS at the locations as shown on the Contract Drawings.
- B. All speakers to be provided to be in coordination with and be part of the turn-key PA System in Section 27 51 16.
- C. Platform tube light tray speakers and walkway light tray speakers to be Type 1 all-environment enclosed speakers. Type 1 speakers to be Bogen model A2T or Authority approved equivalent.
- D. Platform speakers in the split platform canopies to be Type 3 all-environment speakers. Type 3 speakers to be Bogen model A6T or Authority approved equivalent.
- E. All exposed Type 3 platform speakers and surface brackets on the north split platform and the south split platform to be white in color.
- F. All recessed Type 1 tube platform speakers and brackets in the integral light tray to be black in color.
- G. All recessed Type 1 walkway speakers and brackets in the integral light tray to be black in color.
- H. Station area speakers to be Type 2 ceiling mounted environmental speakers, recessed in removable ceiling tiles. Type 2 speakers to be Bogen model OCS1 or Authority approved equivalent.
- I. All station area Type 2 speaker baffles to be off-white in color.
- J. The station PA System in Section 27 51 16 has been designed to provide adequate sound levels to its coverage area. Speakers are located throughout the platform area, station area, and walkways. The speaker volume to be adjusted to 85dBspl, nominal at the ear level, at 15 to 20 dB higher than the average background noise but not to exceed 95 dB at the ear level. Each speaker to have an externally adjustable multi-tap transformer for control of individual speaker volume levels.
- K. This section includes the station microphone requirements.
- L. The station PA System to include noise sensors.

1.03 RELATED WORK

- A. PUBLIC ADDRESS SPEAKERS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"

2. Section 27 51 16 "PA System"

1.04 REFERENCES

A. Technical Abbreviations and Definitions.

1. ABS - Acrylonitrile butadiene styrene thermoplastic
2. dB – Decibel
3. dBspl – Decibel, sound pressure level
4. Hz – Hertz
5. kHz - Kilohertz
6. PA – Public Address
7. UL – Underwriters Laboratories
8. W - Watt

B. Publications.

1. None.

C. Reference Standards.

1. ANSI/NFPA 130-1993 - Fixed Guideway Transit Systems
2. ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications
3. Mil-Std-810E – Test Methods for Temperature, Humidity, Ultraviolet light, and Salt Spray.
4. UL-2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

- B. In addition to the submittals required in Specification 27 00 10 – Communications General Provisions, Section 1.06, the following to be submitted:

1. A detailed schematic diagram showing existing PA system and equipment, new A/V-PA system equipment and interface equipment.
2. Local Field Acceptance Test Procedures for approval by IDOT and the CTA.
3. Local Field Acceptance Test Reports for each installation showing satisfactory operation and performance to meet specifications.
4. Test Reports containing evidence of each installation inspection, certified as correct by the Contractor's Quality Control Authority for the project, to be submitted to IDOT and the CTA for approval. The Contractor to receive approval of such inspection certification before applying power to the paging equipment covered by such certification.

- C. Shop Drawings to be submitted prior to installation for review and approval by IDOT and the CTA. Work to not commence at the RT station until the submitted drawings are approved.

1. The approved drawings to be marked by the Contractor during installation to reflect the final installation. The marked-up drawings to be submitted as part of the final acceptance of the installation.

- D. The Contractor to design wiring diagrams and final circuit drawings for equipment being furnished by the Contractor and for any approved changes to equipment in the Contract Documents. The Contractor to be solely responsible for the correctness of the wiring diagrams and final circuit drawings being designed and for the correctness of any existing drawings being reused as part of a complete working system

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.
- B. In addition to the System Warranty period identified in Specification Item 27 00 10- Communications General Provisions, Section 1.08, each speaker to include a manufacturer material warranty of 5 years, transferable to the CTA after Final Acceptance by IDOT.

1.09 TRAINING

- A. The training for this section to be in accordance with Specification Item 27 00 10- Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 TYPE 1 SPEAKER

A. GENERAL:

1. Type 1 speakers to be Bogen model A2T or Authority approved equivalent.

B. ENVIRONMENTAL:

1. Weather-tight, fully sealed enclosure
2. Rated for operation in any weather, including but not limited to, extreme heat and cold, constant humidity, ice, snow, rain, sun/ultraviolet light, wind and salt spray.
3. Compliant with Mil-Std-810E
4. High density polypropylene enclosure with UV inhibitors

C. ACOUSTICAL:

1. Sensitivity: 88 dBspl (1Wattat1 meter)
2. Dispersion Angle: 80 degrees
3. Frequency Response: 55 Hz – 20 kHz (half-space response)
4. Coaxial design:
 - a. 6 inch low frequency transducer, metal alloy cone with deep anodized surface treatment for rigidity and corrosion resistance (paper or plastic cones will not be allowed)
 - b. Voice coil centered in a high gauss, low viscosity magnetic fluid to prevent corrosion in the magnet gap and allow for heat transfer under high power input
 - c. Compounded rubber cone gasket to withstand all environmental conditions
 - d. ½ inch high frequency transducer, environmental polycarbonate diaphragm
 - e. low viscosity magnetic fluid to dampen the voice coil and allow for heat transfer under high power input

D. ELECTRICAL:

1. 70-volt rated operation
2. Integrated power transformer with 4W, 8W, and 16W power taps
3. Gold-plated, rust-proof barrier terminal screws

E. PHYSICAL:

1. Surface mount, fully sealed enclosure for installation via bracket on poles, walls, or other exterior surfaces, as well as installation within light trays or above ceilings designed to produce a recessed speaker mount installation.
2. Dimensions: 8 inches Diameter (round) x 8-1/4 inches Deep, maximum
3. Weight: 10 lbs, nominal
4. Side mount threaded bolt taps, 5/16-18 thread, for mounting to the speaker bracket. Mounting bolts to be tamper-resistant.
5. Color: Option to include black, white, and green

F. TERMINAL COVER

1. Each speaker to include a terminal block electrical cover to provide additional weather protection of the wires and terminal connections. The cover to fit securely over the terminal block area on the back of the speaker.
2. The terminal cover to be Bogen model ASTB4 or Authority approved equivalent.

G. BRACKET

1. Each speaker to include a mounting bracket with multiple mounting angles.
2. The bracket to be heavy-gauge steel, treated and painted for all environment installations.
3. The bracket to be painted to match speaker color.
4. See Contract Drawings for additional bracket information.

2.02 TYPE 2 SPEAKER

A. GENERAL:

1. Type 2 speakers to be Bogen model OCS1 or Authority approved equivalent.

B. ENVIRONMENTAL:

1. Rated for operation in indoor environments with harsh conditions, including but not limited to, extreme heat and cold, and constant humidity.
2. UL Listed
3. UL-2043 compliant

C. ACOUSTICAL:

1. Sensitivity: 89.5 dBspl (1Wattat1 meter)
2. Dispersion Angle: 140 degrees
3. Frequency Response: 45 Hz – 19 kHz (half-space response)
4. Coaxial design:
 - a. 6-1/2 inch low frequency transducer, metal alloy cone with deep anodized surface treatment for rigidity and corrosion resistance (paper or plastic cones will not be allowed)
 - b. Voice coil centered in a high gauss, low viscosity magnetic fluid to prevent corrosion in the magnet gap and allow for heat transfer under high power input
 - c. Compounded rubber cone gasket to withstand all environmental conditions
 - d. 3/4 inch high frequency transducer, black polycarbonate diaphragm low viscosity magnetic fluid to dampen the voice coil and allow for heat transfer under high power input.

D. ELECTRICAL:

1. 70-volt rated operation
2. Integrated power transformer with 1W, 2W, 4W, 8W, 16W, and 32W power taps
3. Front mounted power tap selector via rotary switch, under a removable grille
4. Four screw snap-lock input connector with loop-through connections

E. PHYSICAL:

1. Recessed ceiling mount for installation above ceilings.
2. Plated steel can enclosure
3. ABS constructed front baffle, with 94VO fire rating Acrylonitrile butadiene styrene.
4. Integral ceiling mount clamps that rotate outwards to provide a secure installation to the ceiling surface.
5. Attachment point for steel tether support cable
6. Dimensions: 12-3/8 inches Diameter (round) x 12 inches Deep, maximum
7. Weight: 10 lbs, nominal
8. Perforated speaker grille, heavy-gauge steel, color-matched to baffle
9. Color: off-white baffle with mild texture finish for paint adhesion

F. BRACKET

1. Each speaker to include a 10 foot maximum steel tether cable to provide secondary suspension of the speaker as a safety mechanism if the primary ceiling mount fails.
2. The safety tether cable to be Bogen CK10 or Authority approved equivalent.
3. Each speaker to include a ceiling tile support ring bracket to provide mounting support of the speaker in the suspended ceiling grid system.
4. The bracket to be of rigid steel or aluminum sized to mount the Type 2 speaker specified herein.
5. The ceiling tile support ring bracket to be Bogen TBCR or Authority approved equivalent.
6. See Contract Drawings for additional bracket information

2.03 END OF LINE FILTER MODULE

- A. Each speaker circuit to include an End of Line filter module to allow automatic 20 kHz system testing from the PA system for testing continuity of speaker wiring to the end of each speaker circuit.
- B. The EOL filter module to meet the following requirements:
 1. NFPA 72 compliant
 2. Senses current for speaker line integrity performed by the PA System microprocessor controlled amplifier chassis.
 3. Test tone limits:
 - a. Continuous tone: less than or equal to 5V at 20 kHz
 - b. Time limited tone: greater than 5V at 20 kHz
 - c. Four minutes max: 10 V at 20 kHz
 - d. 100 V maximum test tone voltage
 4. Slip on, insulated, crimp-type, female connectors, 6 inch leads
 5. 1.96 inch L x 0.956 inch W x 1 inch D
 6. Temperature:
 - a. -40 degrees F to +212 degrees F

2.04 AMBIENT NOISE REMOTE SENSOR

- A. Outdoor type Ambient Noise Sensor Units to be installed at each Station. These units, to monitor ambient noise levels and transmit information to the Ambient Noise Interface Card in the equipment rack as a varying DC waveform. The unit consists of an omnidirectional condenser microphone, a preamplifier and an analog conversion module. The units to be installed in weatherproof stainless steel enclosures.
- B. The units to be IED 540GS Remote Sensor or approved equal.

2.05 SIDETONE MICROPHONE:

- A. Outdoor type Side tone Microphone(s) to be installed at each Station. These units to monitor page audio side tone. The units to include a dynamic microphone element and associated impedance matching module. The microphones to be installed in weatherproof stainless steel enclosures and meet the following criteria:
 1. Size: 3" x 4" x 3.5" (approx.)

2. Weight: 2 lbs. (approx.)
3. Connection: XLR connector
4. Plating: Gold
5. Source Impedance: 200 Ohm
6. Microphone type: Dynamic
7. Freq. Response: 200-7.5 kHz
8. Sensitivity: 4.0 mv/PA
9. Enclosure type: Stainless Steel

B. The units to be DBI LZM-WP or approved equal.

2.06 STATION PA CONTROL CONSOLE:

A. Each Rail Station Customer Assistant shelters and Platform Supervisor's Booth to be equipped with a new desktop PA Control Console for initiating local audio and visual public address announcements. The desktop console to be equipped as follows:

B. Input for an existing hand held PA microphone with preamplifier:

1. Impedance: 150 ohms
2. Frequency Response: 100 to 6,000 Hz
3. Sensitivity: E.I.A. -154 dB
4. Output: -60 dB with reference to 0 dB

C. Liquid crystal display to display information associated with preprogrammed resident public address announcements selected locally from console keypad. The LCD display is used to indicate and prompt the user for information, and to show progress.

D. Busy and ready LED indicators to be visible on the front panel. The red Busy LED indicates when the portion of the system requested is in use. The green Ready LED indicates when the desired portion of the system is available for an action or an announcement.

E. Console Keypad: Heavy-duty vandal-proof 12-button touch-tone telephone type keypad (0-9, #, *).

F. The console housing to be tamperproof and constructed of stainless steel. The console to include a lockable base for attachment to counter or wall. When inserted in it's lockable base the unit will have provisions for a CTA lock to be used for security. The base will also protect incoming cables and connectors from vandalism.

G. The audio section of the microphone stations includes a balanced differential line receiver, a compressor, and a balanced line driver output which is capable of driving extremely long lines of shielded twisted pair cable without significant high frequency rolloff. A test oscillator is built into the microphone station. It can be switched into the audio section, either by a specific keypad entry at the microphone station or by an entry at the main computer.

H. Ethernet IP communications / POE Power

I. The unit to be IED 528 PA Control Console or approved equal

2.07 SPEAKER CABLE

A. Provide speaker cables as follows:

1. Speaker Wire: 1 TP, 16 AWG, shielded; PVC insulation, aluminum polyester

shield, chrome sunlight resistant PVC jacket, temperature rating: 105 degrees C, and voltage rating: 300 volts.

PART 3 EXECUTION

3.01 TYPE 1 and TYPE 3 SPEAKERS

- A. All Type 1 and Type 3 speaker installations to be coordinated with the Architectural Reflected Ceiling Plans in the Contract Drawings.
- B. Install Type 1 and Type 3 speakers in accordance with the speaker manufacturer recommended installation procedures.
- C. Type 1 and Type 3 speakers along the north split platform and the south split platform to be installed recessed between the station canopy support steel plates.
- D. Type 1 and Type 3 speakers along the north split platform and the south split platform to be angled such that the center axis of each speaker is pointed at the mid-point of the platform between the track edge and back edge of the platform.
- E. Type 1 and Type 3 speakers along the center platform tube structure to be installed recessed within the speaker cavity integrated into the continuous light tray.
- F. Type 1 and Type 3 speakers along the center tube structure to be angled such that the center axis of each speaker is pointed directly down at a right angle to the platform.
- G. Type 1 and Type 3 speakers along the ground level walkway to be installed recessed within the speaker cavity integrated into the continuous light tray.
- H. Type 1 and Type 3 speakers along the ground level walkway to be angled such that the center axis of each speaker is pointed at the mid-point of the walkway, to the extent the light tray structure allows.
- I. Type 1 and Type 3 speaker connections to be protected by a rubber cover that allows speaker wires to enter at tip and continue through to terminate on the speaker terminals.
 - 1. The tapered tip of the terminal cover to be cut to allow a snug fit over the speaker wires.
 - 2. The tapered tip to be treated with a weather-proof silicone-based caulk after installation to prevent the ingress of moisture through the terminal cover tip.
 - 3. The terminal cover base to be snugly affixed to the back of the speaker over the terminal connections.

3.02 TYPE 2 SPEAKER

- A. All Type 2 speaker installations to be coordinated with the Architectural Reflected Ceiling Plans in the Contract Drawings.
- B. Install Type 2 speakers in accordance with the speaker manufacturer recommended installation procedures.
- C. Type 2 speakers in the ground level station areas to be installed in coordination with the station ceiling grid system.
- D. Each Type 2 speaker to be installed with a steel safety tether cable to the back of each speaker. The other end of the safety tether cable to be looped around or attached to a

structural support above the ceiling grid, and independent of the ceiling grid structure.

- E. Each Type 2 speaker to be installed with a ceiling tile support ring bracket to provide support above and independent of the ceiling grid panels.
- F. Type 2 speakers in the station areas to be angled such that the center axis of each speaker is pointed directly down at a right angle to the floor.

3.03 END OF LINE FILTER MODULE

- A. The EOL module to be installed at the last speaker of each speaker chain circuit.

3.04 SPEAKER CABLE

- A. Refer to PA System Placement Plans in the Contract Drawings for speaker circuit correlation.
- B. Speakers in the Main Station, Center Station, and South Station to be daisy-chain connected, in their respective speaker zones, with a single-pair, single cable.
- C. Speakers along the platform and the ground level walkway to be daisy-chain connected, in their respective speaker zones, with two single-pair cables. There to be dual speaker circuits for each zone, with one circuit alternating every other speaker to the end of the speaker chain, while the second circuit alternates the remaining speakers to the end of the speaker chain.
- D. Shield continuity for shielded cable to be maintained throughout each run and the shield grounding to be accomplished only at the communication room end of each shielded cable run.
- E. All speaker circuits to be terminated on the wall field in the Communications Room in the Main Station on a disconnect-capable terminal block as the demarcation point between the field speakers and the amplifier chassis. Each terminal block to meet the following requirements:
 - 1. 12 pole terminations (accommodates 6 pairs of conductors)
 - 2. Heavy nickel-plated, brass contacts
 - 3. Sliding mechanical link to open a circuit pair without disconnecting wire connections
 - 4. High isolation barriers between contacts
 - 5. UL listed
 - 6. Rated at 600 volts, 30 amperes
 - 7. Marker strips to identify each conductor/pair
 - 8. Clear cover
 - 9. The speaker circuit demarcation block to be Megger brand, States Products series Type NT, model CSM-25012, or Authority approved equivalent.

3.05 CONDUIT

- A. All conduit to comply with Specification 26 05 00 – Raceways and Boxes.
- B. All PA conduit and raceways to be hidden from public view to the extent possible. Any installations that cannot be hidden from view to be brought to the attention of the Authority for resolution prior to proceeding.

END OF SECTION 27 51 17

SECTION 28 16 19
INTRUSION DETECTION REMOTE DEVICES AND SENSORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing INTRUSION DETECTION REMOTE DEVICES AND SENSORS at the locations as shown on the Contract Drawings.
- B. The Intrusion Detectors to be provided in the station houses to monitor for intrusion into the floor space of the stations when stations are closed overnight.
- C. The Intrusion Detectors to be connected and integrated with the station SCADA system for collecting intrusion status alarms for alerting CTA Control Center and as logical inputs to automated security detection and response systems such as the Video Management System.
- D. The Contractor to provide the Intrusion Detection system in the Peoria St. including all necessary hardware and software to make the system operational and be compatible with the CTA's existing SCADA Master System at the Control Center. The Contractor to be responsible for all circuit assignments, programming, and wiring with the system and the CTA's existing SCADA Master network to make the SCADA remote terminal unit and intrusion detection devices operational.

1.03 RELATED WORK

- A. INTRUSION DETECTION REMOTE DEVICES AND SENSORS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. PIR – Passive Infra-Red
2. UL – Underwriters Laboratories
- B. Publications.
1. None.
- C. Reference Standards.
1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00

10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 INTRUSION DETECTOR SENSOR

A. GENERAL:

1. The Intrusion Detector Sensor to be a multiple technology sensor utilizing:
 - a. PIR sensor
 - b. Microwave range adaptive radar sensor
 - c. Tri-focus optical sensor
2. Intrusion Detector Sensor to be Bosch DS-9370 or Authority approved equivalent.

B. PHYSICAL:

1. Power: 9VDC to 15 VDC
2. Current (maximum): < 26mA
3. Current (standby): 18mA @ 12VDC
4. Outputs (tamper): normally-closed (NC) contacts rated at 25VDC, 125mA maximum
5. Outputs (trouble): solid state relay normally-closed (NC) contacts
6. Outputs (alarm): solid state relay, normally-closed (NC) contacts, power supervised; 3W, 125mA, 25VDC, <10 Ohms
7. Dimensions: 5 inches x 2.75 inches x 2.25 inches
8. Construction: high-impact ABS plastic, white
9. Alarm Indicators:
 - a. Blue LED
 - b. Yellow LED
 - c. Red LED
10. Detection Zones: 86

11. Temperature: -30 degrees c to +55 degrees C
12. Relative Humidity: 0 to 95% non-condensing
13. Built-in Bubble Level
14. Anti-mask technology

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Intrusion Detector Sensor to be mounted following the manufacturer's recommendations and industry best practices.

END OF SECTION 28 16 19

SECTION 28 23 16
SECURITY VIDEO TERMINAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing SECURITY VIDEO TERMINAL at the locations as shown on the Contract Drawings.
- B. The Security Video Terminal to be a 19" Touchscreen VGA monitor, installed in each CA Kiosk.
- C. The SVT to be mounted in the CA Kiosk on a swing arm wall mount that allows the monitor to swing away from the wall/window and flip flat against the kiosk window such that the CA can view the monitor through the window from the exterior of the kiosk.
- D. The SVT to include a VGA and USB Touchscreen extender to drive VGA video and touch screen USB control of the Video Client PC in the Communications Room to the SVT in the CA kiosk.
- E. The SVT to be Litemax #SLD-1954-EGBL-C01 / AD5766GDVA, or Authority approved equivalent. The swing arm wall mount to be Innovative Office Products #9110-8.5-4, or Authority approved equivalent. The SVT VGA/USB Media Converter to be Apantec #TSE-1-Eu / TSE-1-Ru or Authority approved equivalent.

1.03 RELATED WORK

- A. SECURITY VIDEO TERMINAL specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. CCTV – Closed Circuit Television
2. SVT – Security Video Terminal
- B. Publications.
1. None.
- C. Reference Standards.
1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 SECURITY VIDEO TERMINAL

A. GENERAL:

1. Security Video Terminal to be Litemax #SLD-1954-EGBL-C01 / AD5766GDVA or Authority approved equivalent.

B. PHYSICAL:

1. Display area: 19" diagonal display area, 376.32 mm x 301.06 mm
2. Display: Sunlight readable, TFT LCD, LED backlit display
3. Touchscreen
4. Anti-reflective glass
5. Brightness: 1000 cd/m²
6. Resolution: SXGA 1280 x 1024 video
7. Contrast Ratio: 1000:1
8. Pixel Pitch: 0.294 (H) x 0.294 (V) mm
9. Viewing Angle: 80 degrees (H) x 85 degrees (V)
10. Display Colors: 16.7M
11. Response Time: 5ms
12. Control: 5 key control (on/off, menu, select +/-, auto)
13. Setup: on-screen menu
14. Mount: VESA 100mm

C. ELECTRICAL:

1. Power Input: 12VDC
2. Power Consumption: 37W

D. MECHANICAL:

1. Indoor rated operation
2. Dimensions: 451mm x 343mm x 58mm
3. Weight: 5.35 kg

2.02 SVT WALL MOUNT BRACKET

A. GENERAL:

1. SVT Wall Bracket to be Innovative Office Products #9110-8.5-4 or Authority approved equivalent.

B. PHYSICAL:

1. VESA 75mm and 100mm standard
2. Swivel Range: 30 degrees up/down, 30 degrees left/right
3. Two piece arm extensions: 8.5 inch / 4 inch
4. 35lb maximum support

2.03 VGA / USB TOUCHSCREEN EXTENDER

A. GENERAL:

1. The SVT VGA/USB Touchscreen Extender to extend VGA video and USB control over a single Cat-5e/Cat-6 cable.
2. SVT VGA/USB Touchscreen Extender to be Apantec #TSE-1-Eu / TSE- 1-Ru or Authority approved equivalent.

B. PHYSICAL:

1. Resolution: up to 2048 x 1536
2. Distance: up to 1,000 feet
3. Setup: Plug and Play, software to not be required to setup and operate
4. VGA / USB Extender Pair:

a. Extender Unit:

- 1) Input: (2) USB, Audio
- 2) Output: VGA, Audio, RJ45
- 3) Cable: 3 ft VGA / Audio / USB combination cable
- 4) Mount: magnetic
- 5) Power: USB 5V, External 5VDC, 1000mA

b. Receiver Unit:

- 1) Input: RJ45
- 2) Output: VGA, USB, Audio
- 3) Adjustments: equalizer, gain
- 4) Mount: magnetic
- 5) Power: 5VDC, 1000mA

PART 3 EXECUTION

3.01 INSTALLATION

- A. The SVT to be mounted in the CA Kiosk on a swing arm wall mount that allows the monitor to swing away from the wall/window and flip flat against the kiosk window such that the CA can view the monitor through the window from the exterior of the kiosk.
- B. The VGA/USB Touchscreen extender unit to be installed in the Communication Room CCTV rack connected to the USB control and VGA video port of the Video Client PC. The receiver unit to be installed behind the video monitor in the kiosk connected to the USB input and the VGA video port of the SVT.
- C. The Contractor to provide all required power, USB, and VGA cables to make the SVT fully operational with the Video Client.

END OF SECTION 28 23 16

SECTION 28 23 31
CLOSED CIRCUIT TELEVISION FIXED CAMERAS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing CLOSED CIRCUIT TELEVISION CAMERAS at the locations as shown on the Contract Drawings.
- B. This section specifies the requirements for the procurement, installation, and testing of in-ceiling mountable, pendant mount, and surface mount CCTV fixed dome high definition (HD) digital color cameras.
- C. The fixed dome HD camera to be capable of accepting Power over Ethernet (IEEE 802.3af) or 24 VAC.
- D. The fixed dome HD camera to follow open IP standards and to have H.264 and MJPEG Compression Capability.
- E. The fixed dome cameras to be provided with 2.2mm-6mm lens or 2.8mm-8mm lens as required for the fields-of-view specified.
- F. The fixed camera on each elevator shaft exterior viewing the rail right-of-way to include a separate low voltage infrared illuminator, 24VAC, 850 nm wavelength, with 10 degree cone of illumination and 98 foot illumination range. The infrared illuminator to be Raytec #RM25-F-10-TEL, or Authority approved equivalent.
- G. The digital HD cameras provided under this contract to be Pelco IEE20 Sarix Series, or Authority approved equivalents.

1.03 RELATED WORK

- A. CLOSED CIRCUIT TELEVISION CAMERAS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. CCTV – Closed Circuit Television
- B. Publications.
1. None.
- C. Reference Standards.
1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCTS

2.01 GENERAL

- A. All equipment and materials used to be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components to have been thoroughly tested and proven in actual use.
- C. H.264 and MJPEG Compression Capability & Open IP Standards

2.02 IN-CEILING FIXED DOME CAMERA - TYPE 1

- A. The Type-1 indoor/outdoor integrated CCTV high definition (HD) digital camera and enclosure to consist of a tamper/impact resistant, in-ceiling mountable dome enclosure with integrated fixed camera and lens. The integrated high definition (HD) digital camera and lens to consist of a camera and lens module that is packaged separately for shipment and which to allow the installation of the enclosure to precede installation of the camera and lens.
- B. Dome Enclosure
 1. The enclosure back box, when installed, to not require more than 2.45 inches of space inside a wall or ceiling.
 2. The overall height of the enclosure to not exceed 5.73 inches and the overall diameter to not exceed 7.45 inches, when installed.
 3. The enclosure to be provided with a cover assembly secured with tamper resistant, pin-in-hex screws. The tightening tool to also be provided.
 4. The dome to consist of a max 5.00-inch diameter, 0.125-inch thick polycarbonate high security bubble that has high optical clarity and nominal distortion at all camera angles.

5. The bubble to be puncture-proof, capable of withstanding pointed impact forces of 35 foot-pounds without creating an internal depression greater than 0.2 inches.
6. The bubble to be impact resistant; capable of withstanding repeated multiple blunt impact forces of up to 100 foot-pounds.
7. The dome to be available in clear or smoked versions. The clear version to have zero light loss and the smoked version to have a maximum light loss no greater than 1.0 f-stops.
8. The enclosure to be NEMA 4 and IP66 rated, when installed.
9. The enclosure to be suitable for use in environmental air handling spaces.
10. The enclosure, when loaded with camera and integrated low temperature resistor array to be capable of operation between -22°F to 122°F and to be capable of de-icing the viewing surface of the enclosure down to -10°F .
11. The enclosure to be provided with an adapter plate for mounting to a standard 4S or double-gang electrical box or which can be used as a backing flange when mounting to a drop ceiling.
12. A clearly labeled pigtail to be provided for connecting 24 VAC power.
13. An RJ-45 connector to be provided for connecting video.
14. The enclosure, without integrated low temperature resistor array, at temperatures above 35°F , to consume less than 6W of power.
15. The enclosure, when loaded with camera and integrated low temperature resistor array, at temperatures under 35°F , to consume no more than 13W of power.
16. The enclosure, when installed, to have no exposed cables.

C. Integrated Camera and Lens Assembly

1. The integrated digital camera and lens assembly to be capable of accepting a wide range of megapixel varifocal CS-Mount lenses.
2. The high definition CMOS digital camera to consist of 1/3-inch format interline transfer imager meeting NTSC (EIA) or PAL (CCIR) signal format specifications.
3. The cameras to be available in high definition color capable of maximum resolution of 1920 x 1080
4. The HD digital dome camera to be capable of accepting megapixel varifocal lenses.
5. The high definition color camera to be available with a 2.2mm to 6.0 mm varifocal length lens with on/off DIP switch for auto iris capability. This camera to utilize a 1/3-inch CMOS imager.
6. All CMOS high definition (HD) cameras to be capable of electronic light control, commonly referred to as electronic shutter. The electronic shutter range to be 1-1/100,000 sec.
7. All color cameras to be 2:1 interlace and capable of AC line lock that is adjustable via potentiometer on the camera board.
8. The digital camera to be capable of supporting two simultaneous video streams.
9. All HD cameras to have a convenient video setup jack for viewing video when installing the camera.

D. Camera Module

1. The camera module to have two spring steel, compressible arms that create an interference fit that holds the module in place.
2. During installation and camera adjustment, the module design to allow adjustment of the camera on three axes to allow maximum flexibility during scene adjustment.
3. The three axes to be pan, tilt, and rotation.
4. The camera and lens, when installed on a ceiling or horizontal surface, to be capable of 368 deg of pan and no less than 160 deg of tilt. When field of view is factored, apparent tilt to be no less than 90 deg.
5. The camera and lens, when installed on a wall or vertical surface, to be capable of 180 deg of pan and no less than 140 deg of tilt.
6. The camera module to consist of the camera, lens, low temperature array, and 24 VAC power supply board.
7. The camera module to be easy to install by being provided with a quick connect/disconnect connector.
8. The removable camera module to allow unrestricted access to the inside of the enclosure during installation of the enclosure.

E. The CCTV HD camera to be provided with a manufacturer's warranty covering repair or replacement of defective parts for a period of two years from the date of shipment.

F. The Type CCTV HD digital camera to be the Pelco IEE20 Series Camclosure or Authority approved equivalent.

2.03 SURFACE MOUNT FIXED DOME CAMERA - TYPE 2

A. The Type 2 indoor/outdoor integrated CCTV high definition (HD) digital camera and enclosure to consist of a tamper/impact resistant, surface-mount dome enclosure with integrated fixed camera and lens. The integrated camera and lens to consist of a camera and lens module that is packaged separately for shipment and which to allow the installation of the enclosure to precede installation of the camera and lens.

B. Dome Enclosure

1. The enclosure to have the following external dimensions: overall height to not exceed 6.28 inches, and enclosure diameter to not exceed 7.69 inches.
2. Tamper resistant, pin-in-hex screws and tightening tool to be provided to secure the cover assembly to the enclosure body.
3. The dome to consist of 5.00-inch diameter, 0.125-inch thick polycarbonate high security bubble that has high optical clarity and nominal distortion at all camera angles.
4. The bubble to be puncture-proof, capable of withstanding pointed impact forces of 35 foot-pounds without creating an internal depression greater than 0.2 inches.
5. The bubble to be impact resistant capable of withstanding repeated multiple blunt impact forces up to 100 foot-pounds.
6. The dome to be available in clear or smoked versions. The clear version to have zero light loss and the smoked version to have a maximum light loss no greater than 1.0 f-stops.
7. The enclosure to be NEMA 4 and IP66 rated.
8. The enclosure, when loaded with camera and integrated low temperature resistor array to be capable of operation between -22°F to 122°F and to be capable of de-icing the viewing surface of the enclosure down to -10°F .
9. The enclosure, when loaded with camera and integrated low temperature resistor array, to be capable of de-icing the viewing surface of the enclosure down to -10 degrees F.

10. The enclosure to be capable of mounting to a standard 4S or double-gang electrical box using the adapter plate (provided), or to the switch plate or lighting hole pattern that is standard on most double-gang mud rings.
11. The enclosure to be capable of connection to 3/4-inch NPT threaded conduit from the side, or to a 3/4-inch conduit adapter from the rear of the enclosure.
12. The integrated camera system to be capable of accepting 24 VAC (+/- 10%) input power.
13. Inside the enclosure to be provided a connector board that has terminals for connecting 24 VAC
14. An RJ-45 connector to be provided for connecting video
15. The enclosure, without integrated low temperature resistor array, at temperatures above 35°F, to consume less than 6W of power.
16. The enclosure, when loaded with camera and integrated low temperature resistor array, at temperatures under 35 degrees F, to consume no more than 13 watts of power.
17. The enclosure, when installed, to have no exposed cables.

C. Integrated Camera and Lens Assembly

1. The integrated digital camera and lens assembly to be capable of accepting a wide range of megapixel varifocal CS-Mount lenses.
2. The high definition CMOS digital camera to consist of 1/3-inch format interline transfer imager meeting NTSC (EIA) or PAL (CCIR) signal format specifications.
3. The cameras to be available in high definition (HD) color capable of maximum resolution of 1920 x 1080
4. The HD digital dome camera to be capable of accepting megapixel varifocal lenses.
5. The high definition color camera to be available with a 2.2mm to 6.0 mm varifocal length lens with on/off DIP switch for auto iris capability. This camera to utilize a 1/3-inch CMOS imager.
6. All CMOS high definition (HD) cameras to be capable of electronic light control, commonly referred to as electronic shutter. The electronic shutter range to be 1-1/100,000 sec.
7. All color cameras to be 2:1 interlace and capable of AC line lock that is adjustable via potentiometer on the camera board.
8. The digital camera to be capable of supporting two simultaneous video streams.
9. All HD cameras to have a convenient video setup jack for viewing video when installing the camera.

D. Camera Module

1. The camera module to have two spring steel, compressible arms which create an interference fit that holds the module in place.
2. During installation and camera adjustment the module design to allow adjustment of the camera on three axes to allow maximum flexibility during scene adjustment.
3. The three axes to be pan, tilt, and rotation.
4. The camera and lens, when installed on a ceiling or horizontal surface, to be capable of 360 degrees of pan and no less than 70 degrees of tilt. When field of view is factored, apparent tilt to be no less than 90 degrees.
5. The camera and lens, when installed on a wall or vertical surface, to be capable of 180 degrees of pan and no less than 140 degrees of tilt.
6. The camera module to consist of the camera, lens, low temperature array, and 24 VAC power supply board.
7. The camera module to be easy to install by being provided with a quick connect/disconnect connector.
8. The removable camera module to allow unrestricted access to the inside of the

enclosure during installation of the enclosure.

9. The indoor/outdoor integrated CCTV HD camera and surface-mount dome enclosure to be provided with a manufacturer's warranty covering repair or replacement of defective parts for a period of two years from the date of shipment.

- E. The Type-2 CCTV camera to be the Pelco IEE20 Series or Authority approved equivalent.

2.04 PENDANT MOUNT FIXED DOME CAMERA - TYPE -3

- A. The Type- 3 indoor/outdoor integrated CCTV high definition (HD) digital camera and enclosure to consist of a tamper/impact resistant, pendant mountable dome enclosure with integrated fixed camera and lens. The integrated high definition (HD) digital camera and lens to consist of a camera and lens module that is packaged separately for shipment and which to allow the installation of the enclosure to precede installation of the camera and lens

B. Dome Enclosure

1. The dome enclosure to be pendant mount, capable to install with wall bracket or hung from the ceiling as applicable.
2. The overall height of the enclosure to not exceed 7.54 inches and the overall diameter to not exceed 7.63 inches, when installed.
3. The enclosure to be provided with a cover assembly secured with tamper resistant, pin-in-hex screws. The tightening tool to also be provided.
4. The dome to consist of a max 5.00-inch diameter, 0.125-inch thick polycarbonate high security bubble that has high optical clarity and nominal distortion at all camera angles.
5. The bubble to be puncture-proof, capable of withstanding pointed impact forces of 35 foot-pounds without creating an internal depression greater than 0.2 inches.
6. The bubble to be impact resistant; capable of withstanding repeated multiple blunt impact forces of up to 100 foot-pounds.
7. The dome to be available in clear or smoked versions. The clear version to have zero light loss and the smoked version to have a maximum light loss no greater than 1.0 f-stops.
8. The enclosure to be NEMA 4 and IP66 rated, when installed.
9. The enclosure to be suitable for use in environmental air handling spaces.
10. The enclosure, when loaded with camera and integrated low temperature resistor array to be capable of operation between -22°F to 122°F and to be capable of de-icing the viewing surface of the enclosure down to -10°F .
11. A clearly labeled pigtail to be provided for connecting 24 VAC power.
12. An RJ-45 connector to be provided for connecting video.
13. The enclosure, without integrated low temperature resistor array, at temperatures above 35°F , to consume less than 6W of power.
14. The enclosure, when loaded with camera and integrated low temperature resistor array, at temperatures under 35°F , to consume no more than 13W of power.
15. The enclosure, when installed, to have no exposed cables.

C. Integrated Camera and Lens Assembly

1. The integrated digital camera and lens assembly to be capable of accepting a wide range of megapixel varifocal CS-Mount lenses.
2. The high definition CMOS digital camera to consist of 1/3-inch format interline transfer imager meeting NTSC (EIA) or PAL (CCIR) signal format specifications.
3. The cameras to be available in high definition color capable of maximum resolution of 1920 x 1080

4. The HD digital dome camera to be capable of accepting megapixel varifocal lenses.
5. The high definition color camera to be available with a 2.2mm to 6.0 mm varifocal length lens with on/off DIP switch for auto iris capability. This camera to utilize a 1/3-inch CMOS imager.
6. All CMOS high definition (HD) cameras to be capable of electronic light control, commonly referred to as electronic shutter. The electronic shutter range to be 1-1/100,000 sec.
7. All color cameras to be 2:1 interlace and capable of AC line lock that is adjustable via potentiometer on the camera board.
8. The digital camera to be capable of supporting two simultaneous video streams.
9. All HD cameras to have a convenient video setup jack for viewing video when installing the camera.

D. Camera Module

1. The camera module to have two spring steel, compressible arms that create an interference fit that holds the module in place.
2. During installation and camera adjustment, the module design to allow adjustment of the camera on three axes to allow maximum flexibility during scene adjustment.
3. The three axes to be pan, tilt, and rotation.
4. The camera and lens, when installed on a ceiling or horizontal surface, to be capable of 368 deg of pan and no less than 160 deg of tilt. When field of view is factored, apparent tilt to be no less than 90 deg.
5. The camera and lens, when installed on a wall or vertical surface, to be capable of 180 deg of pan and no less than 140 deg of tilt.
6. The camera module to consist of the camera, lens, low temperature array, and 24 VAC power supply board.
7. The camera module to be easy to install by being provided with a quick connect/disconnect connector.
8. The removable camera module to allow unrestricted access to the inside of the enclosure during installation of the enclosure.

E. The CCTV HD camera to be provided with a manufacturer's warranty covering repair or replacement of defective parts for a period of two years from the date of shipment.

F. The Type-3 CCTV HD digital camera to be the Pelco IEE-20 Series or Authority approved equivalent.

PART 3 EXECUTION

3.01 INSPECTION

- A. The Contractor to be responsible for inspecting all equipment ordered when it arrives on site. Any damaged equipment to be returned and replaced at the Contractor's expense.
- B. The Contractor to ensure that all returned equipment is replaced within thirty (30) days. No schedule modifications to be allowed due to returned equipment unless authorized in writing by CTA.

END OF SECTION 28 23 31

SECTION 28 23 32
CLOSED CIRCUIT TELEVISION PTZ CAMERAS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This specification consists of furnishing and installing CLOSED CIRCUIT TELEVISION PTZ CAMERAS at the locations as shown on the Contract Drawings.
- B. This section specifies the requirements for the procurement, installation, and testing of in-ceiling mountable, pendant mount, and surface mount CCTV PTZ dome high definition (HD) digital color cameras.
- C. The PTZ dome HD camera to be capable of accepting Power over Ethernet (IEEE 802.3af) or 24 VAC.
- D. The PTZ dome HD camera to follow open IP standards and to have H.264 and MJPEG Compression Capability.
- E. The CCTV HD PTZ camera system provided under this contract to be Pelco Spectra HD Series network dome system, or Authority approved equivalent.

1.03 RELATED WORK

- A. CLOSED CIRCUIT TELEVISION PTZ CAMERAS specified to be furnished and installed herein have related work in various other sections, including, but not limited to:
1. Section 27 00 10 "Communications General Provisions"

1.04 REFERENCES

- A. Technical Abbreviations and Definitions.
1. CCTV – Closed Circuit Television
2. PTZ – Pan / Tilt / Zoom
- B. Publications.
1. None.
- C. Reference Standards.
1. None.

1.05 QUALITY ASSURANCE

- A. The quality assurance for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.05.

1.06 SUBMITTALS

- A. The submittals for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.06.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The delivery, storage, and handling for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.07.

1.08 WARRANTY

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.08.

1.09 TRAINING

- A. The warranty for this section to be in accordance with Specification Item 27 00 10 - Communications General Provisions, Section 1.09.

PART 2 PRODUCT

2.01 GENERAL

- A. All equipment and materials used to be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components to have been thoroughly tested and proven in actual use.
- C. H.264 and MJPEG Compression Capability & Open IP Standards

2.02 HD PTZ DOME NETWORK CAMERA

- A. The indoor/outdoor HD series network dome system to be consisting of a dome drive with a variable speed/high speed pan and tilt drive unit with continuous 400° rotation, 1/3-inch high resolution color CCD camera, motorized zoom lens with optical and digital zoom and auto focus; and an enclosure consisting of a back box, lower dome and a quick-install mounting. The camera system to allow to control and monitor video over an IP network using standard web browser.
- B. Dome Drive
 1. The drive unit to contain a built-in menu system for setup of programmable settings and password protection.
 2. The drive to contain a user-selectable automatic power-up to the mode of operation the dome will assume when power is cycled, including automatically returning to position or function occurring before a power outage.
 3. The drive to provide on-screen diagnostic system information, pan and tilt locations, zoom ratio, compass heading.
 4. The drive to be capable of freezing the current scene of video during present movement.
 5. The drive to allow for user-definable compass setup and user-definable locations of all labels and displays. The user to be allowed to select the time duration of each display and the video output level (normal or high to compensate for long video cable runs).
 6. The drive to allow for up to four user-defined programmable patterns including pan, tilt, zoom and present functions. The patterns length to also be user-defined, based on dome memory. The pattern programming to be done through the

- control keyboard or through the dome system on- screen menu.
7. The drive to be provided with a minimum of eight zones (programmable in size) which can be labeled with up to 20 characters each or set to blank the video in the zone.
 8. The drive to be provided with programmable limit stops for manual panning, auto/random scanning, and frame scanning.
 9. The drive to be provided with an RJ-45 plug-in jack and remote data port for control and setup of unit and for uploading new operating code and language file updates.
 10. Alarms to be individually programmed for three priority levels, to initiate a stored pattern, or to go to an associated preset when received. After the alarm is acknowledged the dome to return to previous programmed state or its previous position.
 11. The variable speed/high speed pan and tilt drive unit to meet or exceed the following design and performance specifications:
 - a. Pan Speed: Variable between 400° per second; continuous pan to 0.1° per second
 - b. Vertical Tilt: Unobstructed tilt of +0° to -90°
 - c. Manual Control Speed: 0.1° to 80° per second, and pan at 150° per second in turbo mode. Tilt operation to range from 0.1° to 40° per second
 - d. Automatic Preset Pan Speed of 400° and a Speed: tilt speed of 160° per second
 - e. Presets: Eighty preset positions with a 20-character label available for each position; programmable camera settings, including selectable autofocus modes, iris level, LowLight limit, and backlight compensation, for each preset; command to copy camera settings from one preset to another; preset programming through control keyboard or through dome system on-screen menu
 - f. Preset Accuracy: +/- 0.1
 - g. Proportional Pan/Tilt Speed decreases in Speed: proportion to the increasing depth of zoom
 - h. Motor Drive: Cogged belt with 0.9° stepper motor
 - i. Motor Operating Mode: Microstep to 0.015° steps
 - j. Motor: Continuous duty, variable speed, operating at 18 to 32 VAC, 24 VAC nominal
 - k. Inner Liner: Rotating black ABS liner inside sealed lower dome
 - l. Alarm Inputs: Seven N.O./N.C. dry contacts
 - m. Alarm Outputs: One auxiliary Form C relay output and one open collector auxiliary output
 - n. Alarm Output Auxiliary outputs can be Programming: alternately programmed to operate on alarm
 - o. Window Blanking: Eight four-sided, user-defined shapes, with each side being of different lengths; window blanking setting to turn off at user-defined zoom ratio; window blanking set to opaque gray or translucent smear; blank all video above user-defined tilt angle; blank all video below user-defined tilt angle
 - p. Auto sensing: Automatically sense and respond to protocol utilized for controlling unit whether Coaxitron or RS-422 P or D protocols; accept competitors' control protocols with the use of optional translator cards
 - q. Auto Flip: Rotates dome 180° at bottom of tilt travel
 - r. Power Consumption: 73VA max

C. HD PTZ CAMERA FEATURES

1. Image Sensor type: 1/3-inch CCD
2. Zoom: 18X optical zoom;
3. Light sensitivity: f/1.6; 2,850°K SNR>24dB
4. Aspect Ratio: 4.3 or 16.9
5. Day/Night capability: Yes
6. Wide Dynamic Range: 60dB
7. Maximum Resolution: 1920X1080
8. Lens: F1.6 (f=4.7mm to 84.6 mm optical)
9. Iris control: Auto iris with manual override

D. VIDEO

1. The dome system to support open architecture connectivity for third party software recording solutions allowing integration into any IP –based HD system.
 - a. Video Encoding: H.264 high, main, or base profile and MJPEG
 - b. Video Stream: Up to two simultaneous stream
 - c. Frame rate: Up to 30 (dependent up on coding, resolution and Stream configuration)
 - d. Scanning System: 2:1 Interlace

E. ELECTRICAL

1. Port requirement: RJ-45 connector for 100Base-Tx; Auto MDI/MDI-X; Auto negotiate/manual settings
2. Cable type: Cat5 or better for 100baseTx
3. Input Voltage: 18 to 32 VAC; 24 VAC nominal
4. Input Power: 23VA nominal (without heater); 73VA nominal (with heater)
5. PoE: IEEE802.3af (without heater)

F. Back Box Features

1. The HD series dome system to have the choice of four back box mounting models: (In-Ceiling, Environmental in-ceiling, Pendant and environmental Pendant.) The environmental back box and lower dome to meet or exceed NEMA Type 4X, IP66 Standards.
2. The back box and lower dome to be provided with an easy-access trap door that allows complete access to the installation wiring and, when closed provided complete separation of the wiring from the dome drive mechanics. The back box and lower dome to allow for quick, positive mechanical and electrical disconnect from the dome drive with the use of any tools.
3. The cameras to be capable of surface-mount, in-ceiling, or pendant installation with a pressurized option.
4. The back box to have a built-in memory that stores camera/dome settings.
5. The back box to have the ability to accept an optional board that converts video output to passive, unshielded twisted pair transmission and an optional third-party board that converts video output and control input to fiber optic transmission.
6. The back box to be provided with seven alarm inputs.
7. The back box to be provided with built-in memory storage of camera and location specific dome settings such as presets and patterns. If a new dome drive is installed in the back box, all settings to download automatically into the new dome drive.

3.01 INSPECTION

- A. The Contractor to be responsible for inspecting all equipment ordered when it arrives on site. Any damaged equipment to be returned and replaced at the Contractor's expense.
- B. The Contractor to ensure that all returned equipment is replaced within thirty (30) days. No schedule modifications to be allowed due to returned equipment unless authorized in writing by CTA.

END OF SECTION 28 23 32

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. These specifications provide for the furnishing, installation, and connection of the fire alarm equipment required to form a complete coordinated system ready for operation. The Fire Alarm System to include, but not be limited to, alarm initiating devices, control panel, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.
- B. The work described in this Section consists of all labor, materials, equipment and services necessary and required to complete and test the Fire Alarm System of a City of Chicago Elevator Recall. Any material not specifically mentioned in this Specification or not shown on the Drawings but required for proper performance and operation to be furnished and installed.
- C. Basic Performance:
1. Addressable Signal Line (SLC) circuits to be wired Class A (NFPA Style 6), supervised for opens and grounds.
- D. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions to immediately occur:
1. Indicate the device in alarm at the main control panel, by activating an audible and visual alarm at the main control panel.
 2. Provide two dry contacts signals, for both Alarm and trouble indications. Contacts for each of the two alarm conditions to be for connection to a local annunciator, and for connection to the Communications System for transmitting to the Central Control Office. Provide necessary 48VDC rated auxiliary contacts for remote signal via scada system to remote CTA central office.

1.03 RELATED WORK

- A. Related work specified elsewhere:
1. Section 26 05 00 "Raceways and Boxes"
 2. Section 26 10 00 "Basic Electrical Materials and Methods"
 3. Section 26 12 30 "Wires, Cables, Splices, Terminations"
 4. Section 26 14 10 "Wiring Devices"
 5. Section 26 17 00 "Local Control"
 6. Section 26 17 50 "Local Control Panels"
 7. Section 26 19 00 "Grounding"
 8. Section 26 19 50 "Identification"

1.04 REFERENCES

- A. The publications listed below form a part of this specification. National Fire Protection Association (NFPA) - USA:

No. 70-90 National Electrical Code (NEC).
No. 71-89 Central Station Signaling Systems.
No. 72-2007 Protective Signaling Systems, National Fire-Alarm Code

- B. Underwriters Laboratories Inc. (UL) - USA:

No. 268 Smoke Detectors for Fire Protective Signaling Systems, July 20, 1987.
No. 864 Control Units for Fire Protective Signaling Systems, May 26, 1987.
No. 268A Smoke Detectors for Duct Applications.
No. 521 Heat Detectors for Fire Protective Signaling Systems.
No. 464 Audible Signaling Appliances.
No. 1971 Visual Signaling Appliances.
No. 38 Manually Actuated Signaling Boxes.
No. 346 Waterflow Indicators for Fire Protective Signaling Systems.

- C. City of Chicago Building Code:

No. Article 620
No. Article 760

1.05 QUALITY ASSURANCE

- A. The fire alarm system to comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system to be electrically supervised and monitor the integrity of all conductors.

1.06 SUBMITTALS

- A. Shop Drawings: Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, and complete wiring point-to-point diagrams.
- B. Manuals: Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets (with model numbers to be used indicated).

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL

- A. All equipment and components to be new, as that of Notifier current model, NFS300 or approved equal.
- B. All equipment and components to be installed in strict compliance with manufacturers' recommendations.
- C. All Equipment to be attached to and ceiling/floor assemblies and to be held firmly in place. (e.g., detectors to not be supported solely by suspended ceilings). Fasteners and supports to be adequate to support the required load.

- D. Equipment mounted in locations on grade, or electrically continuous with slabs on or below grade, to be installed so as to maintain the electrical system isolation from earth ground.

2.02 CONDUIT AND WIRE

A. Conduit:

1. Conduit to be in accordance with Section 26 05 00 Raceways and Boxes of this Specification.
2. Conduit fill to not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable to be separated from any open conductors of Power, or Class 1 circuits, and to not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Conduit to be 3/4 inch minimum.

B. Wire:

1. All fire alarm system wiring to be new and installed in conduit.
2. Number and size of conductors to be as recommended by the fire alarm system manufacturer.
3. All field wiring to the indicating devices, to be completely supervised.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets to be UL listed for their use and purpose.

- D. The Fire Alarm Control Panel (FACP) to be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit to be labeled at the Emergency Power Panel as "FIRE ALARM". Fire Alarm Control Panel Primary Power wiring to be 12 AWG.

2.03 FIRE ALARM CONTROL PANEL

- A. The addressable FACP to communicate with and control the following types of equipment used to make up the system: smoke detectors, heat detectors, manual pull stations, and other system controlled devices.

1. Function: The FACP to perform the following functions:

- a. Supervise and monitor all initiating device circuits and alarm indicating circuits for trouble and alarm conditions.
- b. Detect the operation of any initiating device circuit and visually and audibly annunciate the alarm condition at the panel display, and operate all auxiliary relays required for remote indication of the alarm.
- c. Visually and audibly annunciate any trouble, supervisory or alarm condition at the panel display, and operate all auxiliary relays required for remote indication of the alarm.

2. The FACP to perform the following options: Alarm Verification, Waterflow, Supervisory, Silence Inhibit, Disable Circuits, and Walk Test.

- B. The Control Panel to include Indicating Circuits, Alarm Contacts, Trouble Contacts, Supervisory Contacts, the required number of Initiating Device Circuits, and two dry output alarm contacts. Output Contacts to be rated 48VDC.

- C. System Display: The System Display to indicate the status of the following system

parameters:

AC POWER	Green LED
SYSTEM ALARM	Red LED
RELEASE	Red LED
SUPERVISORY	Yellow LED
SYSTEM TROUBLE	Yellow LED
CIRCUIT TROUBLE	Yellow LED
ALARM SILENCED	Yellow LED
POWER TROUBLE	Yellow LED

D. System Functions:

1. System Status LEDs: The alarm, supervisory, or trouble LEDs to flash until events have been acknowledged. Any subsequent new alarm, supervisory, or trouble will flash new conditions only.
2. Zone Disable: Disable/Enable to be accomplished using a special sequences of operation of the 4 control switches. If a zone has been disabled, an alarm to activate the red zone LED, but not the piezo or any output circuit.
3. Last Event Recall: Last Event Recall to allow the user to display the previous panel status. Last Event Recall may be used to diagnose intermittent trouble conditions.

E. The Control Panel to also include the following Features:

1. Battery/Earth fault supervision.
2. Alarm verification to be an optional selection, and to only verify smoke detectors and not other devices on the same circuit.
3. Walk Test to be provided which allows a single installer to test the system without returning to the panel to reset the system.
4. Watchdog timer to supervise the microprocessor to be provided.
5. Slide-in zone identification labels to be provided.
6. Bell circuit disconnect switch to be provided.

F. Power Supply:

1. The Power Supply for the Fire Alarm Control Panel to be integral to the Fire Alarm Control Panel itself, and to provide all control panel and peripheral device power needs.
2. Input power to be 120 VAC, 60 HZ. The power supply to provide an integral battery charger for use with batteries up to 12 AH.
3. It to provide 2.25 amperes of regulated 24 VDC power for Audio-Visual alarm indicating devices, four-wire Smoke Detector Power @ 24 VDC up to 200 ma, and Non-Resettable Power @ 24 VDC up to 200 ma.
4. The Power Supply to be designed to meet UL and NFPA requirements for power-limited operation on all initiating and indicating circuits.
5. Positive-temperature-coefficient thermistors, circuit breakers, fuses, or other over-current protection to be provided on all power outputs.

G. Mechanical Design: The control panel to be housed in a factory approved cabinet designed for mounting directly to a wall or vertical surface. The panel to be designed to meet the requirements of Section 16175 Local Control Panels of this Specifications, except the color to be RED.

H. System Circuit Supervision:

1. The FACP to supervise all circuits to annunciators and peripheral equipment, and

- annunciate loss of communications with these devices.
2. Each initiating device circuit to have individual alarm and trouble indication.

2.04 BATTERIES

- A. To be 12 volt, sealed Gell-Cell type (2 required).
- B. Battery to have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
- C. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage to not be required.

2.05 SYSTEM COMPONENTS

- A. Ionization Type Area Smoke Detectors
 1. Ionization type smoke detectors to be two wire, 24 VDC type using a dual unipolar chamber.
 2. Each detector to contain a remote LED output and a built-in test switch.
 3. Detector to be provided on a twist-lock base.
 4. It to be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.
 5. A visual indication of an alarm to be provided by dual latching Light Emitting Diodes (LEDs) over 360°, on the detector, which may be seen from ground level. This LED to flash every 10 seconds, indicating that power is applied to the detector.
 6. The detector to not alarm when exposed to air velocities of up to 1200 feet per minute. The detector screen and cover assembly to be easily removable for field cleaning of the detector chamber.
 7. All field wire connections to be made to the base through the use of a clamping plate and screw.
- B. Automatic Heat Detectors:
 1. Automatic Heat Detectors to be combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit for areas where ambient temperatures do not exceed 100 degrees, and 200 degrees for areas where the temperature does not exceed 150 degrees.
 2. Automatic Heat Detectors to be low profile, ceiling mount type with positive indication of activation.
 3. The rate of rise element to consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and to operate when the rate of temperature rise exceeds 15 degrees F. per minute.
 4. The fixed temperature element to consist of a fusible alloy retainer and actuator shaft.
 5. Automatic Heat Detectors to have a smooth ceiling rating of 2500 square feet.
- C. Addressable Relay Modules:
 1. Addressable Relay Modules to be made available for Elevator Recall control with the following functions; Primary Elevator Recall, Secondary Elevator Recall, and Fireman Helmet Signaling. The relay to be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil to be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
 2. Final connections to be coordinated with the elevator contractor.

2.06 FIRE ALARM ANNUNCIATOR PANEL

- A. The Contractor to provide a Fire Alarm Annunciator Panel (FAAP) located in the CA Kiosk.
- B. The FAAP to comply with the Code and local authority.

2.07 MANUFACTURERS:

- A. Acceptable manufacturers of the fire alarm system to be as manufactured by Notifier, Simplex, Siemens or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation to be in accordance with the NEC, NFPA 72, and local codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers to be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors to not be installed prior to the system programming and test period. If construction is ongoing during this period, measures to be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators to be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. At the final inspection a factory trained representative of the manufacturer of the major equipment to perform the tests in Article 3.03 TESTS.

3.02 TEST

- A. Provide the service of a competent, factory-trained Authority or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
 - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
 - 3. Verify activation of all flow switches.
 - 4. Open initiating device circuits and verify that the trouble signal actuates.
 - 5. Open and short indicating appliance circuits and verify that trouble signal actuates.
 - 6. Ground circuits and verify response of trouble signals.
 - 7. Check presence and audibility of tone at all alarm notification devices.
 - 8. Check installation, supervision, and operation.
 - 9. Verify that each initiating device alarm is properly received and processed by the FACP (Walk Test).
 - 10. Conduct tests from the FACP to verify trouble indications for common mode failures, such as alternating current power failure.

3.03 FINAL INSPECTION

- A. At the final inspection a factory trained representative of the manufacturer of the major equipment to demonstrate that the systems function properly in every respect.

3.04 INSTRUCTION

- A. Provide eight hours of instruction to the Authority's personnel. "Hands-on" demonstrations of the operation of all system components and the entire system to be provided.

END OF SECTION 28 31 00

SECTION 31 20 00
EARTHWORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section includes but is not limited to the following:

1. Preparing and grading subgrades and providing subbase course for slabs on grade, walks, curb and gutter and pavements.
2. Excavating and backfilling for building foundations and footings, column foundations and footings, piers and other structures.
3. Excavating and backfilling for concrete for bollards, guard rails, fence posts, and other site work.
4. Soil and grading for planters, trees, shrubs and landscaping.
5. Removal and disposal of unsuitable soil or subgrade materials. Removal and stockpiling of material suitable for backfilling.
6. Providing, installing and compaction of fill and backfill materials.
7. Excavating and backfilling for underground sewer, water supply, catch basins, manholes, meter vault and electrical utilities and appurtenances.
8. Any other earthwork as shown on the drawings or required for installation of the new work.

- B. Related Sections: The following sections contain requirements that relate to this section.

1. Division 02 Section, Demolition.
2. Division 03 Section, Concrete.
3. Division 32 Section, Landscaping.

1.03 DEFINITIONS

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal or stockpiling of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Authority. Unauthorized excavation, as well as remedial work directed by Authority, shall be at Contractor's expense.
1. Fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Authority. Unauthorized excavation may also be filled with compacted granular fill as approved by the Authority.
- C. Unsuitable materials: Material which cannot be left in place for structural support of subsequent construction as determined by the Authority or material contaminated with fuel oil, lead or any other regulated substances.
- D. Additional Excavation: When excavation has reached required subgrade elevations, notify Authority, who will make an inspection of conditions. If Authority determines that bearing materials at required subgrade elevations are unsuitable, continue excavation

until suitable bearing materials are encountered and replace excavated material as directed by Authority.

- E. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.
- F. Structure: Buildings, foundations, piers, footings, slabs, curbs, or other man-made stationary features occurring above or below ground surface.

1.04 SUBMITTALS

- A. Test Reports: As required by the Authority, submit the following reports directly to the Authority from the testing services, with copy to Contractor:
 - 1. Verification of suitability and bearing capacity of each footing subgrade material, in accordance with specified requirements.
 - 2. Field reports; in-place soil density tests.
 - 3. Test reports of unsuitable and contaminated soil or subgrade materials.
- B. Procedures, certificates, permits, transport and land fill manifests, etc. for removal and disposal of contaminated soil or subgrade materials.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Except as modified herein, the work shall be performed in accordance with the applicable portions of the Illinois Department of Transportation Standard Specifications.
 - 1. Except as modified herein, the work shall conform to the applicable portions of the Standard Specifications, Section 502.
 - 2. Excavation of unsuitable material shall conform to Section 202.
 - 3. The installation of porous granular backfill shall conform to Section 209.
- C. Testing and Inspection Service: Contractor will employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations as required by the Authority.
- D. Follow all applicable regulations, codes and ordinances when removing, transporting and disposing of contaminated subgrade materials.

1.06 PROJECT CONDITIONS

- A. Site Information:
 - 1. Soil conditions are assumed to meet the design criteria implied by the details indicated on the drawings.
 - 2. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- B. Existing Utilities: Locate existing underground utilities, including cables, in areas of excavation work. If utilities and cable are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered

- during excavation, consult utility owner immediately for directions. Cooperate with Authority and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Do not interrupt existing utilities serving facilities occupied by Authority or others, except when permitted in writing by the Authority and then only after acceptable temporary utility services have been provided. Provide minimum of 48-hour notice to Authority, and receive written notice to proceed before interrupting any utility.
- C. Use of Explosives: Use of explosives is not permitted.
- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
1. Operate warning lights as recommended by authorities having jurisdiction.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 3. Protect pedestrian traffic from excavations. Provide barricades and jersey barricades as required and approved. Re-route traffic from traffic areas to be excavated.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SW, SP and SM.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT. Unsuitable materials shall be classified as material which cannot be left in place for structural support of subsequent construction as determined by the Authority or material that is contaminated.
- C. Aggregate Base Course shall be type "A" in accordance with Section 301 of the Standard Specifications.
- D. Subbase Material: To be used under structural slabs, and paved areas shall be naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand, gradation CA-6 in accordance with IDOT Section 704 of the Standard Specifications.
- E. Backfill and Fill Materials: Satisfactory soil materials free of expansive clay, rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, wood, glass, metals, organic material, vegetation, concrete, bituminous pavement, masonry and other deleterious matter from on-site excavation or CA-6 as per IDOT 1988. In addition, the material shall have a standard dry density of not less than 90 pounds per cubic foot when tested in accordance with AASHTO T99 and shall not possess an organic content greater than 10% when tested in accordance with AASHTO T194.
- F. Granular fill or backfill shall be crushed coarse aggregate having a CA-6 gradation conforming to applicable portions of the Standard Specifications, Section 704.
- G. Porous granular backfill shall have a CA-18 gradation conforming to Section 704 of the Standard Specifications.

- H. Bedding Material: Bedding material shall be coarse aggregate having a CA-11 gradation conforming to Section 1004.01 of the Standard specifications. This material shall be used in all pipe trenches.
- I. Trench Backfill: Trench backfill shall be a fine aggregate having a FA-6 gradation conforming to Article 1003.01 of the Standard Specifications.
- J. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 8 sieve.
- K. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 50 sieve.
- L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- M. The use of chats, wet bottom boiler slag or slag sand shall not be allowed for fill.
- N. Bearing soil or subbase for the installation of concrete foundation work shall be of 3000 psf bearing capacity minimum unless required or noted otherwise.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, crushing, and other hazards created by earthwork operations. Protect landscaping.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Determine the location of any underground utilities or other items or structures that may be close to the proposed excavations. Utility lines are to be flagged before beginning the work.
- D. Contractor is responsible to have the limits and elevations for his excavations properly surveyed by a licensed surveyor, and clearly marked at the site.
- E. Any disturbance or damage to existing structures, utilities, or other property, caused by the Contractor's operation shall be repaired by the Contractor in a manner satisfactory to the Authority and at no additional cost to the Authority.
- F. Existing pavements, alleys, curbs and sidewalks shall be saw-cut prior to removal.

3.02 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction to maintain stable excavations.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Install as required to support excavation. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses. Removal of any temporary earth retention structure shall coincide with placement of backfill and be performed in such a manner as to ensure stability of all adjacent structures.

3.03 DE-WATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3.04 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable, as designated by the Engineer, for backfill and fill. Place, grade, and shape stockpiles for proper drainage. Do not intermix materials. Cover to prevent wind-blown dust.
 - 1. Locate stockpiled excavated materials in a location approved by the Authority.
 - 2. Locate and retain soil materials away from edge of
 - 3. excavations and out of the way of construction activities
 - 4. Dispose of excess excavated soil material and materials not acceptable for use as backfill.

3.05 EXCAVATION

- A. Excavate as required to extent required. Stockpile excavated material suitable for backfill. Remove all unsuitable materials and dispose of all materials not suited for backfill including debris, rubble, abandoned structures, existing foundations and footings, stone bases, stone piers, abandoned utility structures and pipe, pavements, curbs and gutters, tiebacks, deadmen, fill and landscaping not to be reused. All unsuitable materials to be disposed of properly off site.
- B. Excavate unsuitable soil or materials where indicated, under new structure, or as otherwise required. Excavate to solid bearing. Remove and dispose of properly all excavated unsuitable soil or other materials.
- C. Excavations adjacent to existing foundations which are to remain shall be performed in such a way as to insure the stability of the existing foundations.
- D. All excavations shall be secured with temporary barriers.
- E. Do not over excavate unless required to obtain solid bearing or remove unsuitable materials and only with Authority's approval.

3.06 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

- B. Excavations for footings, piers and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

3.07 EXCAVATION FOR PAVEMENTS, WALKS AND SLABS

- A. Excavate surface under slabs to comply with cross-sections, elevations and grades as indicated. Excavate as required to a solid, clean subgrade free of debris.

3.08 APPROVAL OF SUBGRADE

- A. Notify the Authority when excavations have reached required subgrade.
- B. When the Authority determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted fill material as directed.
- C. Unsuitable soil may be soil of insufficient bearing strength or soil that is loose, mixed with debris. Bearing capacity to be determined by independent testing agent. Contractor to arrange for and pay for testing.
- D. Insufficient bearing soil can be corrected by deeper or wider excavation or additional excavation and compacted approved fill. Additional excavation work, compacted fill or additional concrete work required and approved by the Authority will be paid according to the contract provisions for changes in the work. Additional excavation must be approved in writing by the Authority.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activity, as directed by the Authority.

3.09 UNAUTHORIZED, EXCESSIVE OR EXTENDED EXCAVATION

- A. Fill unauthorized, excessive or extended excavation under foundations or footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation; or fill with compacted granular fill, as approved by the Authority.

3.10 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.11 UNSUITABLE EXCAVATION

- A. All unsuitable excavated material and excess material not used for backfill or subgrade shall be disposed of at an approved off-site location. The Contractor shall provide written authorization to the Authority for the use of that location.

3.12 GRANULAR FILL AND BACKFILL

- A. Granular fill or backfill shall be placed in accordance with Article 351 of the Standard Specification.
- B. Granular fill CA-6 shall be used for filling unauthorized, excessive or extended excavations from the bottom of the excavation to the bottom of the footing. Granular fill shall be installed and compacted in layers of maximum depth of 1'-0" per compacted layer.
- C. A Lean Concrete Mix shall be used for fill greater than 1'-0" below the bottom of spread

footing elevation.

- D. Granular backfill CA-6 shall be used for backfilling above the bottom of footing elevation after use of all suitable backfill material.
- E. Before granular backfill material is deposited under and around foundations, it shall contain the proper amount of moisture required for compaction as determined by the Authority for the material and compaction methods used. Moisture shall be added to the material during compaction only when it is necessary to increase the percentage of moisture to obtain satisfactory compaction and to prevent segregation.
- F. Granular fill or backfill CA-6 shall be placed in maximum lifts of six (6) inches and compacted immediately after placing to 95% maximum relative density as determined by AASHTO T99, Method C. The granular material shall be placed in the full width of the excavation with equipment as approved by the Authority and in such a manner which will not cause segregation and which will require minimum blading or manipulation.
- G. Compaction tests shall be made at the direction of the Authority.
- H. Granular fill or backfill CA-6 only shall be used as backfill beneath all areas of new and existing streets, asphalt, sidewalks, curbs or other pavements.

3.13 BACKFILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
 - 1. In All Excavations: General backfill and fills, use satisfactory excavated or borrow material.
 - 2. Under building slabs, walks and pavements, use compacted granular fill only.
 - 3. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance of construction below finish grade including, where applicable, perimeter insulation.
 - 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 5. Removal of trash and debris from excavation.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
 - 7. Removal of temporary sheet piling and cribbing shall coincide with the placement of backfill and be performed in such a way as to insure the stability of all adjacent shoring and structures.

3.14 PLACEMENT AND COMPACTION OF BACKFILL

- A. Place fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

- B. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Backfilling shall proceed immediately after installation of the foundation where applicable, but not prior to seven days after concrete placement or as approved by the Engineer.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- E. Control fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.
 - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
 - a. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
 - b. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
 - 2. Moisture Control: Where subgrade must be moisture conditioned before compaction, uniformly apply water to surface of subgrade material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, fill material that is too wet to permit compaction to specified density.

3.15 GRADING

- A. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- B. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.16 PAVEMENT SUBBASE COURSE

- A. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course. Refer to other Division 2 sections for paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12-inch width of

shoulder simultaneous with the compaction and rolling of each layer of subbase course.

- D. **Placing:** Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations. When a compacted subbase course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.17 FIELD QUALITY CONTROL

- A. All material, fill, and backfilling operations shall be subjected to testing at the Authority's discretion by a qualified testing agency retained and paid for by the Contractor and approved by the Authority.
- B. **Quality Control Testing During Construction:** Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
 - 1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.
 - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
 - b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Authority.
 - 2. **Footing Subgrade:** For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Authority.
 - 3. **Paved Areas and Building Slab Subgrade:** Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.
 - 4. **Foundation Wall Backfill:** Perform at least two field density tests at locations and elevations as directed.
 - 5. If in opinion of Authority, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.18 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. **Removal from Authority's Property:** Remove waste and excess materials, including unacceptable or excess excavated material, trash, and debris, and dispose of it legally off Authority's property.
- B. The Contractor shall furnish the Authority with information on the manner and location of disposal as well as evidence of their authority to use the location.

3.19 REMOVAL AND DISPOSAL OF UNSUITABLE MATERIAL

- A. Material contaminated with fuel oil, lead or any other regulated substance must be excavated, removed and disposed of properly as hazardous waste in approved land fills. All local, state, federal, OSHA, EPA, and any other applicable regulations must be adhered to for the handling, transport, and disposal of such material. This contaminated material may be encountered during excavations, or may be otherwise identified by the Authority.

END OF SECTION 31 20 00

SECTION 34 11 00
BALLASTED TRACK CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

- A. This specification covers the requirements for the Contractor to furnish and install all components necessary to remove and reconstruct existing track sections as required to perform the work. The work includes all labor, material, and equipment necessary to remove and reconstruct the track in accordance with and at the locations identified in the Contract Documents.
- B. Related work specified elsewhere includes all Contract Documents.

1.02 REFERENCES

- A. American Railway Engineering and Maintenance of Way Association (AREMA)
 - 1. Manual for Railway Engineering
- B. Association of American Railroads (AAR)
 - 1. AAR Section G, Wheels and Axis
- C. Code of Federal Regulations (CFR)
 - 1. Title 49, Chapter II Part 213

1.03 SUBMITTALS

- A. Submit a prepared Process Plan which shall include descriptions of items as follows:
 - 1. The sequence of all construction activities.
 - 2. The details of construction for activities and expected durations as follows:
 - a. How the track, including rails, ties, and OTM, will be removed for storage and replacement.
 - b. How will the subgrade be prepared and how will the sub-ballast be spread and compacted.
 - c. How will the ballast be distributed and compacted.
 - d. How the track, including rails, ties, and OTM, will be restored and surfaced to ensure it is at the same line / grade as prior to the work beginning.
 - 3. A list of all equipment to be used during the construction work.
- B. The Contractor shall submit to the Authority product samples, technical literature and specifications for track materials to be used in construction.
- C. The Contractor shall submit to the Authority all testing results from the Ballast supplier defining the limestone ballast as AREMA standard.
- D. The Contractor shall submit to the Authority all test results for fill and sub-ballast material for compliance with IDOT SSRBC requirements specified herein.

1.04 QUALITY ASSURANCE

A. Track Configuration

1. Track configuration shall be designed for use with 115 RE jointed rail. Track gage shall be four feet eight and one half (4' 8½") inches throughout the project limits.
2. Tie spacing shall be twenty four (24") inches measured from the center of tie to the adjacent center of tie.

B. Tolerances From Design

Final established gauge, cross-level, superelevation, vertical and horizontal alignment of tracks shall match existing, and shall be within tolerances from design specified below:

1. Horizontal Track Alignment:

Maximum permissible variation from design shall not exceed	Plus or minus 1/2 inch
Rate of change of permissible variation from design shall not exceed	Plus or minus 3/16 inch middle ordinate to a 31-foot chord on curves, and 1/16 inch middle ordinate to a 31-foot chord on tangent
2. Vertical Track Profile:

Maximum permissible variation from design shall not exceed	Plus or minus 1/2 inch
Rate of change of permissible variation from design shall not exceed	Plus or minus 1/16 inch middle ordinate to a 31-foot chord
3. Track Centers

Maximum permissible variation from design shall not exceed	Plus or minus 1/8 inch for Special Trackwork; Plus or minus 1/2 inch otherwise
--	--
4. Cross Level

Maximum permissible variation from design shall not exceed	Plus or minus 1/16 inch
--	-------------------------
5. Gage variation Minus 0 to plus 1/8 inch
6. No tolerances from design shall be allowed at locations where vertical and horizontal clearances are restricted by the Contract Drawings such as abutments, and overhead structures and platforms.

PART 2 PRODUCTS

2.01 BALLAST

A. Limestone Ballast

1. The ballast furnished and installed as part of lifting, blending, or replacement in existing track that has not been excavated for full depth replacement shall be AREMA No. 4 limestone.
2. The limestone shall conform to all AREMA testing requirements for properties related to soundness, hardness, abrasion, etc. The Contractor shall submit all testing results that enable the supplying quarry to define the ballast as AREMA standard.
3. All test results must have been completed no earlier than within twelve (12) months of the date of the NTP issued by the Authority. All documentation related to testing shall be submitted to the Authority for review and approval prior to the start of work.
4. A sample of the limestone ballast shall be submitted to the Authority for review and approval prior to the start of work.
5. A stone gradation of CA-5 is acceptable provided all other test results comply with AREMA standard for limestone ballast.

2.02 SUB-BALLAST

- A. All sub-ballast furnished and installed shall be a crushed limestone that conforms to the most recent version for the IDOT SSRBC CA-6 gradation standard. The stone must be angular in structure and all forms of crushed concrete, bank run stone or river rock shall be strictly prohibited.
- B. Sub-ballast shall be comprised of virgin material that is of clean, hard, uncoated particles free of lumps of clay, shale and other objectionable materials.
- C. The sub-ballast shall conform to the most recent version of IDOT SSRBC Class A standard for course aggregate sample testing. The supplier must furnish test results that demonstrate the product complies with IDOT SSRBC requirements and the testing were completed no earlier than within the twelve month period before the date of the NTP issued by the Authority.

2.03 FILL MATERIAL

- A. Fill material below the tracks within the zone of influence (1:1 slope from the end of tie) shall be controlled low-strength material (CLSM) conforming to IDOT SSRBC 1019.
- B. Fill material outside of the track zone of influence shall follow the requirements of other specifications or be IDOT CA-11 stone gradation.

2.04 REPLACEMENT MATERIALS

- A. Any material intended to be removed and re-installed that is either lost, missing, stolen or otherwise rendered unsuitable for re-installation shall be replaced by the Contractor at no extra Contract time and no extra Contract cost considered by the Authority. All material replaced by the Contractor shall be approved in writing by the Authority prior to purchase or use.

2.05 DELIVERY AND HANDLING

- A. The Contractor retains the responsibility for the timely delivery of all material needed to complete the full scope of work defined by the Contract.
- B. Handle all materials in a manner, which will prevent damage or fouling during loading, transporting, uploading and distributing.

PART 3 EXECUTION

3.01 GENERAL

- A. To perform the work of this contract, it will be necessary to remove certain sections of the track to install new utility connections and foundations, The Contractor may elect to remove other sections for access.
- B. All work shall be done in accordance with CTA and AREMA standards. The Contractor must allow for time for CTA inspection prior to restoring a section of removed track back into revenue service.
- C. Prior to any track removal and replacement:
 - 1. Mark the area for removal. Removal limits shall be full track panels from the limits of existing joint bars. No cutting of the rail is permitted.
 - 2. IDOT and CTA will inspect the area to be removed and confirm the removal limits.
 - 3. Contractor shall identify any defects in the existing track that may cause a failure in the track system (rails, ties, OTM) when the panel is removed. Repair to these items are not included in the base bid cost and will be performed by others or at additional cost.
- D. The following minimum dimensions apply to the cross-section:
 - 1. Top of Duct Bank to Bottom of Subballast: 12"
 - 2. Subballast Layer: 8"
 - 3. Ballast (to bottom of tie): 12"

3.02 REMOVAL

- A. The Contractor shall remove only those materials intended for removal and shall not damage, mar, or deface material or objects intended to be protected in place.
- B. All necessary safety precautions and protection shall be made for personnel both on site and off site, passersby, equipment in, around, or adjacent to the work. The Contractor's work operations shall be completed in such a manner to avoid interference with the use of adjacent areas or traffic outside of CTA property of the permitted work site, interruption of free passage to and from the work site. Special care and safety precautions shall be taken to avoid the spread of dust and flying particles outside of CTA property or the permitted work area.
- C. Whenever equipment is used that may ignite a fire is used, suitable fire extinguishers shall be at the ready for immediate use. Users of such equipment shall be instructed in the proper method of preventing and extinguishing fires. Any and all Oxygen and Acetylene tanks shall be brought in for each day of work; on-site storage shall be strictly prohibited.
- D. The Contractor retains responsibility for all requirements related to fire protection and prevention.

- E. Metal track or cleat equipment shall not be operated over existing tracks, driveways, sidewalks, curbs, adjacent roadways or other facilities on the site. If access over these facilities is required, the Contractor shall provide timber mats or other protection as necessary for the safe movement of equipment. The damaged facilities resulting from this movement of equipment shall be replaced per section 2.04 of this specification at no extra Contract cost or extra Contract time considered by the Authority.

3.03 CLEANUP AND DISPOSAL OF MATERIAL

- A. All rubbish, debris and all other foreign materials or waste, of whatever nature, resulting from this work or present, including scrap ties, running rail, guard rail, and other track material when the Contractor arrives at the work zone shall be collected and disposed of legally. The Contractor shall provide suitable means for the removal of said materials, debris and rubbish including necessary facilities to saturate all rubbish and debris with water to the extent required to prevent dust arising from the Work.
- B. The Contractor shall steadily and daily remove all materials, debris and rubbish from the site resulting from the work or workers. Under no circumstances shall debris or rubbish be allowed to be stored or accumulate on the site and potentially migrate from CTA property onto the highway or adjacent property.
- C. All materials removed from the project site shall be disposed of legally and in accordance with all appropriate federal, state, and local government laws, codes, ordinances and permit requirements.
- D. The Authority requires that the ties be transported to a recycling facility and may be reused provided the Contractor indemnify the Authority against further liability. The ties may also be transported to an energy waste facility. No ties may be disposed of at in a landfill. Contractor shall provide the disposal site to the Authority for approval.

3.04 EARTHWORK FILL

- A. CLSM shall be placed and installed to provide a firm, uniform base for the installation of sub-ballast. It shall be installed per IDOT SSRBC 593.
- B. CLSM shall be placed after the duct bank concrete forms are stripped and the duct bank concrete has achieved at 2,000 psi.
- C. CLSM can be placed in a single lift.

3.05 SUB-BALLAST PREPARATION

- A. The earth shall be graded to match the cross-section of the finished profile of the tracks. The stone sub-ballast shall be installed on top of the finished grade and compacted to ninety five (95%) percent and verified with a modified proctor test using a nuclear density meter. The stone is typically installed in six (6") inch lifts; however, the sub-ballast may be installed in one eight (8") inch lift provided the required compaction can be developed.
- B. No ballast may be installed over sub-ballast that does not meet the IDOT SSRBC moisture content and demonstrate the compaction capability. It is suggested the Contractor protect the sub-ballast from the elements until such time as the ballast has been placed and finished rolled. No penetration of ballast into sub-ballast shall be accepted.

3.06 PLACING BALLAST

- A. The ballast may be placed over sub-ballast that has been suitably compacted and tested to ensure there will be no penetration of ballast into the line and grade of the sub-ballast.
- B. The equipment used to load and spread ballast must not damage the integrity of the sub-ballast, or drainage system. Damage to the sub-ballast layer must be addressed prior to continuing with the ballast spreading operation.
- C. The ballast shall be shaped in accordance with each section shown on the plans to develop the alignment and profile desired and the top surface of the ballast shall be smooth, flat and uniformly compacted prior to distributing ties.
- D. The ballast shall be spread and compacted in lifts of six (6") inches to ensure proper compaction prior to setting ties on the top surface. Thoroughly compact each ballast layer until stones are firmly interlocked and surface is true and unyielding. Compact each lift with not less than four passes of a roller or a vibratory compactor.

3.07 REINSTALL TRACK

- A. Replace removed track panel section into the prepared bottom ballast section. Properly reseal all ties and adjust any spacing or clipping that may have loosened in the removal. Reinstall joints to non-removed rail sections.
- B. Ballast
 - 1. Enough ballast shall be furnished to fill the tie cribs and also provide an adequate amount of ballast for the initial track raise with sufficient surplus to continue to hold track after initial raise.
 - 2. The ties shall be properly spaced and adjusted before the Contractor shall fill the tie cribs and set the shoulders.
 - 3. The Contractor shall avoid pulling sod, vegetation, and other foreign material onto the track structure or shoulders for purpose of tamping or dressing the ballast section. Any sod, vegetation or foreign matter inadvertently pulled in shall be removed by the Contractor prior to tamping.
 - 4. Clean the track way area of all debris and standing water prior to placing of ballast. Do not place ballast on frozen subgrade or sub-ballast.
 - 5. At no time shall the work be considered complete if even one piece of ballast is in contact with the underside of the running rail. The ballast shall be dressed to one (1") inch below top of tie. Adherence to this requirement is imperative and will rigidly be enforced throughout the limits of the project.
- C. Tamping
 - 1. Tamp ballast with 16 tool, squeeze-vibratory type, power tamping equipment. Control of power tamper shall ensure maximum compaction of ballast uniformly along track. Tamping tools shall be replaced when the working surface is worn more than 30 percent of its original surface area. Procedures and equipment shall be as approved by the Authority.
 - 2. Tamp ballast thoroughly under both sides of tie from a point 15 inches inside rails to ends of tie.
 - 3. For each tie, tamp simultaneously inside and outside both running rails on both sides of tie. Minimum tamping insertions will be two.
 - 4. Immediately following each tamping lift, cribs and shoulders shall be compacted by a machine specifically designed for this purpose. Crib shoulder compaction machine shall be as approved.
 - 5. Snow covered or frozen ballast shall not be tamped under any circumstance.

3.08 FINAL ACCEPTANCE

- A. IDOT and CTA will inspect the replaced track for final acceptance to meet the alignment criteria included in Part 1.04. Minimum requirement shall be to meet the existing conditions.

END OF SECTION 34 11 00

SECTION 36 12 50
UNDERGROUND TRACTION POWER CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This section includes Specifications for furnishing and installing a 2,000-volt, 1500 KCMIL traction power cable.
- B. This item includes replacement of ethylene propylene rubber (EPR) insulated, thermoset, low smoke non-halogen cross-linked polyolefin jacket cable and to be rated for not less than 2000 volts DC distribution. The cable to have excellent heat and moisture resisting characteristics and rated for operation conducting at 900C wet/dry locations, 1300C for emergency and 2500C for short circuit operation. The cable to have special fire resistant characteristics. The cable insulation and jacket to be halogen free. The cable to be listed and approved by UL where applicable

1.03 QUALITY ASSURANCE

- A. Cable construction and testing to conform to the latest applicable standards of the following agencies:
1. ASTM STANDARD B-8
 2. ASTM STANDARD D-470
 3. ASTM STANDARD D-471
 4. ASTM STANDARD D-573
 5. ASTM STANDARD D-2240
 6. ASTM STANDARD D-2802
 7. ASTM STANDARD D-2863
 8. ASTM STANDARD E-662
 9. ICEA S-19-81
 10. ICEA SPECIFICATION S-68-516
 11. IEEE STANDARD 383
 12. MIL C-24643
 13. NAVAL ENGINEERING STANDARD - 711
 14. NAVAL ENGINEERING STANDARD - 713
 15. UL
- B. Where standards are at variance with each other, or with other portions of this Specification, the most stringent requirements, as determined by the Engineer, to apply.
- C. Cable identification to be printed on jacket at 3 feet intervals with manufacturer's name, year of manufacture, conductor size, voltage, insulation and jacket type. The center strand to be stamped at six (6) inch intervals, as follows: manufacturer's and customer's (CTA) ID and year of manufacturing.
- D. The Contractor to furnish, upon request, certified test reports for all specified technical data which illustrates the manufacturer's ability to successfully manufacture the cable. If requested, the Contractor to furnish a detailed list identifying previous users, date cable was supplied, name and telephone number of references. If the Contractor is unable to provide this information upon request, the bid may be rejected.

- E. The Contractor to furnish complete technical information to ensure that the insulation and jacket are acceptability for the type and size of cable involved. The Contractor to quote the insulation and jacket thickness as specified. The Contractor to have had not less than seven (7) years of practical and successful commercial field experience with the EPR insulation and low smoke, non-halogen, cross linked polyolefin jacket. Failure to be able to supply satisfactory evidence of this experience to be cause for rejection of the proposal.
- F. The Contractor to supply a signed statement that the cable insulation and jacket proposed has been tested for, and complies with the requirements of this Specification. The Contractor to furnish a certified copy of the result of these tests.
- G. The Contractor to identify or give the trade name of the insulation and jacket proposed on this Contract.

1.04 SUBMITTALS

- A. The Contractor to submit electronic files in AutoCAD format of shop drawings showing cable construction details and cable ratings.
 - 1. The shop drawing submittal to also include the cable manufacturer's test data, cable splice kits, cable termination kits and pulling compound.
 - 2. The maximum allowable pulling tension, maximum allowable sidewall tension and minimum bending radius for this cable construction to be included.
- B. Certified Test Reports
 - 1. Prior to delivery of the cable to the site, the Contractor to submit electronic files of test reports, certified and notarized.
 - 2. Each certified test report to include all tests as required by this Specification. All testing to be done on the shipping reels.
 - 3. Each certified test report to include the cable footage identification marker numbers.
- C. The cable manufacturer to provide the names and telephone numbers of qualified personnel who may be contacted for technical direction as required in the field.
- D. The Contractor to furnish in electronic files the complete technical information along with adequate successful commercial experience proof in order that the insulation and jacket may be judged as to its acceptability for the type and size of cable involved.

1.05 CONTRACTOR'S QUALIFICATIONS

- A. The Contractor to have a minimum of seven years of documented experience in supplying cable to railway or transit industry for use in installations similar to those required by this project.

PART 2 PRODUCTS

2.01 CABLE CONSTRUCTION:

- A. The conductor to be uncoated soft-drawn annealed copper conductor, 98.16% conductivity, Class B stranded compressed concentric round per ASTM B-8. The conductors to conform to all requirements called for in ICEA S-68-516 for Ethylene Propylene Rubber-Insulated Wire and Cable for Transmission and Distribution of Electrical Energy or in ASTM B-8.
- B. The stranding, thickness and AC test voltage to be as called for the Table I, of this Specification.

TABLE 1

Size KCMIL	Number of Strand	Insulation Thickness Mills	Insulation AC Test Thickness Voltage	Jacket Thickness Mills
500	37	110	10,000	90
1000	61	125	11,000	110
1500	91	145	13,000	110

2.02 CABLE INSULATION:

- A. The cable insulation to be ethylene propylene rubber (EPR) insulation rated 90 degrees C wet or dry. It to comply with ASTM D-2802 "Ozone-Resistant Ethylene Propylene Rubber Insulation for Wire and Cable", except that the insulation resistance to not be less than 100 percent (not 60 percent) of that required for the primary insulation based on the thickness of that insulation.
- B. The EPR insulation to conform to the minimum physical and electrical requirements as specified in Tables 1 and 2 of this Specification.

TABLE 2
ETHYLENE PROPYLENE RUBBER (EPR) INSULATION

OPERATING TEMPERATURE: 90°C DRY OR WET PER ASTM D470

ORIGINAL TENSILE STRENGTH (PSI) MINIMUM.....	1200
ORIGINAL ELONGATION AT RUPTURE (%).....	250
ORIGINAL SET MAXIMUM (%).....	50
TENSILE STRENGTH AFTER AIR OVEN TEST (%).....	75
121 ⁰ C -168 HOURS (PSI)	
ELONGATION AFTER AIR OVEN TEST (%).....	75
PER ICEA S-68-516, TABLE 3.1 AC VOLTAGE TEST (5 MIN)	
DC (TRIPLE AC) VOLTAGE TEST	

Above tests to be performed in water tank on selected completed reels of cable)

INSULATION RESISTANCE MEGOHM/1000 FEET30,000 K
 CONSTANT FOR INSULATION RESISTANCE

Above tests to be performed in water tank on selected completed reels of cable

PER ICEA S-68-516

POWER FACTOR AFTER 24 HOURS AT ROOM TEMP(%) 3.5

PER ICEA S-19-81

OZONE RESISTANCE TEST 3 HOURS PASS

PER ICEA S-68-516

(METHOD EM 60) MOISTURE ABSORPTION TEST (IMMERSED IN 75 C + 10 C WATER)
 DIELECTRIC CONSTANT AFTER 1 DAY IMMERSION (%) 4 .5

INCREASE IN CAPACITANCE 1 TO 14 DAYS (%) 3.5

INCREASE IN CAPACITANCE 7 TO 14 DAYS (%) 2.0

STABILITY FACTOR AFTER 14 DAYS, MAX 1.0

GRAVIMETRIC INCREASE OF MOISTURE MC/IN²(MG) 15

NOTE: 750C requirement, test to be performed on #14 AWG wire using insulation originating from the same batch compound mixture.

- C. All tests performed to pass all moisture and voltage tests herein called for. The insulation to be rated for 1300C emergency overload temperature and 2500C short circuit temperature.
- D. The insulation to strip easily and cleanly from the conductor. An opaque polyester tape may be optionally employed between the conductor and EPR insulation to facilitate strippability.
- E. The insulation to be circular in cross-section, concentric to the conductor. The minimum thickness at any point to not be less than 90% of specified thickness in Table I of this Specification.

2.03 CABLE JACKET:

- A. Directly over the EPR insulation provide an extruded layer of flame retardant thermoset low smoke non-halogen cross-linked polyolefin jacket. The jacket compound to have been approved by Underwriters' Laboratories for use with cable rated for 900C operation, except 1500KCM.
- B. The jacket thickness to be as specified in Table I of this Specification. The minimum thickness at any point to not be less than 90 percent of the specified thickness.
- C. The jacket to conform to the minimum requirements as specified in Table 1 and 3 of this Specification.

TABLE 3

LOW SMOKE, NON-HALOGENATED JACKET

PER ASTM D470
 ORIGINAL TENSILE STRENGTH (PSI)..... 1700
 ELONGATION AT RUPTURE (%)..... 150

PER ASTM D573
 TENSILE STRENGTH AFTER AIR OVEN TEST:
 168 HOURS AT 1210C TENSILE STRENGTH, (%) ORIGINAL, MINIMUM..... 75
 ELONGATION, (%) ORIGINAL, MINIMUM 60
 168 HOURS AT 1500C
 TENSILE STRENGTH, (%) ORIGINAL, MINIMUM 60
 ELONGATION, (%) ORIGINAL, MINIMUM 60

PER ASTM D471, (TABLE #1, NO. 2 OIL)
 TENSILE STRENGTH AFTER OIL IMMERSION
 18 HOURS AT 1210C
 TENSILE STRENGTH, (%) ORIGINAL, MINIMUM 60
 ELONGATION, (%) ORIGINAL, MINIMUM 50

PER ASTM D470
 MOISTURE ABSORPTION, GRAVIMETRIC METHOD
 168 HOURS AT 700C, MG/IN2, MAXIMUM..... 20

PER ASTM D-2240
 DUROMETER Shore A, hold for 1 sec. 90 + 3 (Test to be performed on completed piece of 1500 KCM cable)

PER ASTM D-2863
 LIMITING OXYGEN INDEX, (%), MINIMUM 35

PER ASTM E662
 Perform a smoke density test on materials used in the manufacture of the specified cables. Material to be prepared in slabs of 100 mils thick, plus or minus 5 mils.

Uncorrected maximum specific optical density during first 4 minutes of test:

FLAMING MODE 50
 NON-FLAMING MODE 50

Corrected maximum specific optical density during first 4 minutes of test:

FLAMING MODE 45
 NON-FLAMING MODE 45

Uncorrected maximum specific optical density value obtained within 20 minutes of test:

FLAMING MODE 200
 NON-FLAMING MODE 300

Corrected maximum specific optical density value obtained within 20 minutes of test:

FLAMING MODE 190
 NON-FLAMING MODE 290

PER ASTM 470
 OZONE 24 HOURS AT 150 PPM TO PASS.

PER NES-711
 SMOKE INDEX MAXIMUM
 Material to be prepared in slab of 100 Mils thick, plus or minus 5 Mils 20

PER BURNS AND ROE PROCEDURES
 ACID GAS EQUIVALENT
 Hydrochloric detector tube, with measuring range 0.5 to 25 PPM, similar to National Draeger Tube Part #CH29501)

Not more than PPM/MG 0.1

PER NES 713
 TOXICITY INDEX..... 1.5

PER ICEA S-68-516
 COLD BEND 24 HOURS, 8 TIMES CABLE DIAMETER (-250C) PASS

PER ASTM D470
 TEAR STRENGTH LBS./IN., MINIMUM 35

PER MIL-C-24643
 HYDRAULIC FLUID
 TENSILE STRENGTH, (%) ORIGINAL, MINIMUM 50
 ELONGATION, (%) ORIGINAL, MINIMUM 50

DIESEL FUEL
 24 HOURS IMMERSION AT 490C
 TENSILE STRENGTH, (%) ORIGINAL, MINIMUM 50
 ELONGATION, (%) ORIGINAL, MINIMUM 50

LUBRICATING OIL
 24 HOURS IMMERSION AT 990C
 TENSILE STRENGTH, (%) ORIGINAL 50
 ELONGATION, (%) ORIGINAL, MINIMUM 50

SALT WATER
 24 HOUR IMMERSION AT 200C
 TENSILE STRENGTH, (%) ORIGINAL 90
 ELONGATION, (%) ORIGINAL, MINIMUM 90

PER ASTM D-471
 METHANOL 24 HOURS IMMERSION AT 250C
 TENSILE STRENGTH, (%) ORIGINAL, MINIMUM 50
 ELONGATION, (%) ORIGINAL, MINIMUM 50

GASOLINE
 24 HOURS IMMERSION AT 250C
 TENSILE STRENGTH, (%) ORIGINAL, MINIMUM 50
 ELONGATION, (%) ORIGINAL, MINIMUM 50

2.04 MANUFACTURER:

- A. Acceptable manufacturers to be BIW, Cablec, Okonite or approved equal.

PART 3 EXECUTION

3.01 CABLE TESTING AND INSPECTIONS

- A. Tests to be performed on the insulation, jacket and completed cables in accordance with applicable standards as listed in this specification. Where standards are at variance with each other or with other portions of this specification, or the cable insulation and/or jacket thickness preclude obtaining samples of sufficient size for testing, special arrangements to be made with the Engineer from the Chicago Transit Authority. All tests to be conducted on the cable called for in this Specification.
- B. The Contractor to submit preliminary certified test reports for review by the CTA inspector. All preliminary certified tests to be done with the cable on the shipping reels. The preliminary certified test report to include the conductor DC resistance, insulation resistance, and physical dimensions of the insulation and jacket (i.e.: minimum, maximum and average thicknesses for each reel). Each preliminary certified test report to include cable footage identification and reel number. The CTA inspector will utilize this information in selecting the reels that will be witness tested.
- C. All tests identified in Tables 1, 2, and 3 to be performed on the selected reels and witnessed by the inspector. Included in these tests to be a 70,000 BTU per hour flame test in accordance with IEEE 383 for sizes of cable ordered.
- D. The inspector will select a sample at random for testing each 25,000 feet or less batch produced for each size of cable. In no case to the samples be taken closer than 1,500 feet apart. The inspector will witness tests on a minimum of 5% of each size of cable manufactured for this Contract.
- E. The inspector representing the Authority to have the free entry to the manufacturers facilities at all times while work on the Contract for the CTA is being performed, to all parts of the manufacturers works which concern the manufacture of the cable. The Contractor to afford the inspector, without charge, all reasonable facilities to satisfy him/her that the cable is being furnished in accordance with this Specification. Tests and inspections may be made at the manufacturer's place prior to shipment. Acceptance of material by the Authority at the manufacturer's plant after inspection means that no apparent reason was found to reject the inspected material. However, the Authority reserves the right to reject all material, after delivery to the Authority, which does not conform with this Specification.
- F. Prior to the shipment of any cable, the Contractor to furnish to the Authority electronic files of certified copies of the final certified test results which includes the itemized tests required by this section, using procedures as called for by the respective ASTM Specifications and any other tests mentioned in this section. The Contractor to furnish dimensional cross sections of each size of cable with the certified test results. The certified test reports to also include the identification number of each shipping reel and the footage one each reel.
- G. The Contractor has the responsibility to ensure that all cables supplied will meet this Specification. Cable not in accordance with this Specification will be rejected.
- H. If the Contractor's final certified tests results demonstrate compliance with this Specification and are approved by the inspector acting as a representative for the Authority, the Contractor will be so notified to ship the cable. The Contractor to not ship cable without approval.
- I. To accommodate the inspectors travel requirements, the Contractor to provide the inspector at least a twenty-one working day notice prior to any scheduled testing.
- J. Inspection Costs

1. Any transportation (air-coach class, and any other necessary) and first class lodgings required outside the Chicago Metropolitan area by Authority personnel, their authorized agents or their authorized consultants which are necessary to accomplish the satisfactory inspection of this contract to not be included in the bid price. It is anticipated that one trip for two persons will be made to the manufacturer's plant to inspect the manufacturing process, and one trip for two persons will be made to witness each specified test.
2. However, the number of trips need not be limited to these trips. If problems develop as a result of the Contractors negligence necessitating additional trips, the expenses of these additional trips to be borne by the Contractor.

K. Test Results and Data Required

1. The following data to be included in the certified test reports:
 - a. Type of: cable, insulation and jacket (sheath); cable size, conductor stranding.
 - b. A statement that the cable does or does not comply with this Specification.
 - c. Conductor resistance per 1000 feet.
 - d. Test results for EPR Insulation per Tables 1 and 2 of this Specification.
 - e. Test results for X-linked Polyolefin Jacket per Tables 1 and 3 of this Specification.

L. Packing

1. Cables to be shipped on non-returnable reels with a maximum of 1,500 feet and a minimum of 500 feet of continuous cable per reel.
2. Cable reels before shipment to be wrapped with cardboard or other approved wrapping and be applied complete with 2 inches by 4 inches of wood lagging.
3. Unless otherwise called for, cable of 500 KCMIL and larger, to be supplied on non-returnable reels which conform to the following limits:
 - a. Diameter of reel not to exceed 60 inches.
 - b. Diameter of drum not less than 30 inches.
 - c. Width of reel not to exceed 44 inches.
 - d. Diameter of hole in iron side plate for 2 ½ inch spindle.
4. Cables to be supplied with the ends capped and sealed with heat shrinkable caps to exclude moisture.
5. Each reel or coil to carry suitable tags showing name of co-signee, address, reel identity, order number, name of manufacturer, type of cable, size, weight and length.

M. Delivery

1. All costs of handling and loading, and all transportation charges to the delivery location, to be paid by the Contractor and to be included in the price bid under this Contract.
2. Handling, or rehandling of material, at the Contractor's manufacturing and storage locations, prior to delivery to the job site, to be considered incidental to the Contract.

3.02 INSTALLATION OF TRACTION POWER CABLES

A. GENERAL

1. The Contractor to furnish and install feeder, continuation and tap cables on the Authority right-of-way as shown on the Drawings and/or specified.
2. In general, the cable on each reel to be in one piece of sufficient length for various cutting lengths. Cable to be installed in one continuous length with no splices permitted between dead end assemblies. The Contractor must use extreme care in cutting the cable to the proper lengths. Care to be exercised to minimize the amount of wastage. Whenever cables are cut, the ends to be immediately capped and sealed to positively exclude moisture. The seals to be carefully maintained until final connections are made.
3. Great care to be exercised in handling the cable. Any length of cable damaged to be replaced by the Contractor with cable of the same size, make, type and quality.
4. While cables are being installed, they to be protected by cable rollers so that the insulation and protective covering is not damaged. The method of pulling cables to be approved by the Engineer.
5. Connections of cables to apparatus and equipment to be made with soldered lugs indicated in Section 36 01 90, Traction Power Cable Lugs, bolted to terminals of apparatus and equipment. Only one cable to be soldered in one lug, except as shown on the Drawings or approved by the Engineer.
6. The insulation of all taps and terminal ends of cables to be as shown on the Drawings and in accordance with the Specifications and recommendations of the cable manufacturer.
7. After cables are installed and terminal lugs applied, the protecting caps or tape to be removed, and each length of cable so exposed to be immediately tested with an approved megohm measuring instrument having a 20 megohm/mile range of 1,000 Volt constant potential generator. If the insulation resistance of a wire or a cable so measured is 20 megohm/mile or higher, the terminal work to immediately proceed or if for some reason the terminal work cannot be performed immediately, the cables and wires to be sealed with heat shrinkable caps to exclude moisture as ordered by the Engineer, and to be tested again as specified immediately before terminal lugs are applied. If the insulation resistance is lower than 100 megohms, the cause of the defect to be determined by the Contractor and the wire or cable repaired or replaced if required.
8. The above specified tests to be repeated and any defects corrected as specified, until the respective wires and cables have a tested insulation resistance of at least 20 megohm/mile. After all lugs are applied, but before the connections are made to apparatus, contact rails and other equipment, each continuously connected length of wire and cable to again be tested with the megohm-measuring instrument specified above. If the insulation resistance of a cable so measured is less than the permissible resistance of 20 megohm/mile the cause of the defect to be determined by the Contractor and such defect to be corrected to the satisfaction of the Engineer without additional cost to the Authority.
9. The Contractor to record and provide the Engineer electronic files of the cable tested, length of cable tested, insulation resistance, date of test and type of constant potential generator used.
10. The installation of the heat-shrinkable sleeves on all splices, taps and terminal ends of cable to be as shown on the Drawings, and in agreement with the Specifications and recommendations of the cable manufacturer.

B. UNDERGROUND

1. Unless otherwise noted, all cables run external to equipment assemblies to be installed in conduit, on cable support or on cable rack as indicated on the Contract Drawings.
2. The Contractor to obtain and observe recommendations of the manufacturer as to installation, care and handling of the various cables. Minimum bending radius to not be less than that allowed by ICEA Standards.

3. Cables to be installed in one continuous length between pull points. It to be the Contractor's responsibility to measure each cable run before pulling and cutting, to select lengths from reels of cable which will best employ the stock of cable with minimum cutting waste.
4. Cable to not be pulled off and laid on the ground prior to the installation. Cable grips to be designed for the purpose and to not cut or otherwise damage the cable. No cable to be pulled with ends open. A rubber tape seal to be maintained at all times. The cable to be continuously inspected during installation and any ducts, abrasions, or other injured portion to be brought to the attention of the Engineer and repaired or removed as directed. In drawing cable into conduit, sufficient slack or lead to be allowed to permit the connection to device without splice(s).
5. Cables to be pulled into conduits in accordance with accepted modern practices so as to prevent damage to the cable. No changes will be permitted unless approved by the Engineer. Pulling sheaves to allow for no less than 16 times cable outside diameter for cable pulling radius. This is 32 inches for 1500 KCM cables and 20 inches for 500 KCM cables. Contractor to select cable pull and feed locations best suited to minimize overall cable pulling tension. Cable pulling tensions to be eased by the application of cable pulling lubricant as the cable is pulled into the duct. Cable pulling lubricant to not harm the cable jacket, and to be a type as manufactured by polywater, type "J", or approved equal.
6. Water may accumulate in duct line. Any pumping necessary to keep manholes and ducts dry during Contractor's operations to be performed by Contractor without additional cost. Before making each cable pull, the Contractor to test each duct by pulling a test mandrel through the duct. Test mandrel to be of a size especially designed for the duct being tested with a diameter 1/4 inch less than the conduit diameter. Test pulls are also required to ascertain the clearance or duct lines constructed by others. Any duct installed by this Contractor found blocked during test pulls to be cleaned by Contractor without additional compensation.
7. Wherever there is indication of any accumulation of dirt or water or other foreign matter in any duct or conduits, or whenever deemed necessary by the Engineer, Contractor to swab out such ducts or conduits before pulling in the cable.
8. While cables are being pulled into duct and conduit, they to be protected by underground cable feeder straighteners and cable drawing in protectors. The cable to be fed into the duct through a flexible metal pulling guide. The method of pulling cables into ducts to be approved by the Engineer.
9. Pulling irons to be permanently installed under this contract in convenient locations in manholes for the use of Contractor while pulling and installing cables.
10. 10. Cables to be racked, trained and supported in manholes where the minimum bending radius of this work is eight time the cable outside diameter. This is 16 inches for 1500 KCM cables and 10 inches for 500 KCM cables. Contractor to furnish and install cable support racks in the existing manholes, if necessary, as indicated on the Drawings.
11. Sufficient slack in cables in manholes to be provided so that all connections, splices and test and adjustments can be easily made. Whenever cables are cut the ends to be immediately capped and sealed to positively exclude moisture. The seals to be carefully maintained until final connections are made.
12. Contractor to furnish and install plastic cable duct shields to protect the cable jacket at each duct entrance during cable installation.

END OF SECTION 36 12 50

SECTION 37 84 00
SIGNAL CABLE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. The work to be done under this Section consists of furnishing and installing all of the various types of cable required for signal and signal power system wiring external to wayside relay houses, cases, junction boxes, factory wired mechanisms, and buildings.
- B. Material and workmanship to be of the highest quality assuring durability for minimum life expectancy of forty years. These cables to be suitable for use in the environment to be encountered on a transit signal system and to be certified for continuous operation at 75 degrees Celsius in wet or dry locations with no conductor failing in continuity or with loss of insulation to cross or ground less than one meg-ohm.
- C. Multi-conductor main cable containing more than two conductors to contain a minimum of 20 percent spare conductors or three spare conductors, whichever is greater. Local distribution cable to contain a minimum of ten percent spare conductors or one spare conductor, whichever is greater, except that two conductor cables will not require spare
- D. Main cables to be defined as those cables which run between relay houses, relay rooms, cases, junction boxes, and buildings, or those cables containing conductors for more than one system function. Local distribution cables to be defined as those cables run between a housing and an individual unit of equipment.
- E. Existing aerial cable brackets cannot be reused. All existing signal brackets attached to structures to be removed and replaced with new brackets designed, furnished, and installed by the Contractor.
- F. Cables within a tunnel to be rated for use in a tunnel environment where flame retardancy, low smoke generation, low toxicity, and good circuit integrity during a fire are required.
- G. Express and local signal cables which are in public accessible areas, such as stairways rising to the platforms or at transfer locations, to be protected in RGS conduit

1.03 SUBMITTALS

- A. The Contractor to submit the following to the Authority for approval:
1. List of each cable manufacturer's railway signal installations
 2. Each cable manufacturer's Quality Assurance Program
 3. Full technical data for each type of cable which each cable manufacturer intends to supply
 4. Calculations showing proposed cable conduit and tray fills, including maximum pulling tensions
 5. Power calculations for the peak demand load on each signal power, switch machine power, and signal lighting cable showing ampacity and voltage drop.
- B. The Contractor to submit two certified copies of the following to the Authority for approval.

1. Cable test reports for all demonstration tests required by the Engineer.
 2. Cable test and inspection reports for tests and inspections required and described by these Specifications.
 3. Test reports of cable tests conducted in the field in accordance with approved testing procedures.
 4. Certification that each cable supplied complies with the requirements of these Specifications.
- C. Information to be supplied by certified cable test reports to include the following:
1. Report number
 2. Date and location of test
 3. Description of test and test conditions
 4. Complete cable or wire description
 5. Lot, batch, or reel identification number
 6. Quantitative test results
 7. Summary of the test results
 8. Information on the components of the cable tested to include batch numbers and physical and electrical properties.
- D. The Contractor to submit a complete, signed and notarized standard Wire and Cable Test Report Sheet as part of each cable test report.
- E. The Contractor to furnish to the Authority, product data cut-sheets and a sample specimen of a four foot length, if required, for each proposed cable type. The samples to remain the property of the Authority.
- F. The Contractor to submit, prior to construction, detail plans of any cable raceway installations showing all hardware to be used, methods of attachment, cable routing through junctions, and concrete, backfill or other raceway covering if applicable.
- G. Submit catalog cuts and materials specifications that describe the proposed raceways. Where the specifications call for conformity to material testing, the Contractor to provide documents proofing conformity.
- H. A block diagram to be submitted showing interconnection between major independent elements, such as fiber optic cable, and fiber distribution panels or frames.
- I. Optical path loss budget analysis detailing passive loss on each optical link to be provided under this Contract
- J. The Contractor to submit, prior to pulling cable in conduits, cable pull calculations demonstrating the maximum pulling tension allowable for each cable run.
- K. The Contractor to submit certified test reports verifying that the calculated pulling tension was not exceeded for each cable run in conduit.

1.04 SPLICING

- A. No splices will be allowed in vital or non-vital signal cables.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. All cable to be shipped on reels, adequately protected from damage in shipment by heavy wrapping or wood lagging, to preclude the hazard of reels moving obliquely against each other. The Manufacturer to also be responsible for any change in the shape of the cable occurring in normal transit which results in an increase in the maximum diameter beyond that specified. The external protective wrapping on reels to be secured by at least two steel bands to ensure damage free shipment.
- B. Each length of cable to be wound on a separate reel. Reels to be substantial to withstand handling and to be so designed that the inner end of the cable will be secured and accessible but protected from injury.
- C. If the inner end of the cable projects through the flange of the reel, the inner end to be protected by a suitable cover of metal having rounded ends and sides and securely fastened in place to protect the cable end. Both ends of cable on reel will be secured in place, to prevent their becoming loose in transit or handling of reel.
- D. The diameter of the reel drum to be at least fourteen times the cable diameter to prevent damage to the cable during reeling. The arbor hole to admit a spindle
- E. 2-1/2 inches in diameter without binding. The reels to be designated and constructed as non-returnable when drum size and cable weight and volume permit. The maximum width of reel to not exceed 48 inches unless otherwise specified.
- F. After passing factory tests, cable to be effectively sealed against the entrance of moisture. Both ends of each length of cable to be protected by wrappings of rubber tape and plastic tape, an effective boot taped or sealed into place, or other suitable means approved by the Authority. The use of friction tape, other than an external mechanical protection over an adequate rubber and/or plastic tape, will not be accepted. The cable end protection will be adequate to protect the cable in shipment and prolonged external storage in the weather if not immediately employed without regard to the position of the reel while so stored.
- G. Cable to be closely and tightly wound, in a uniform manner, in each layer on reels.
- H. An arrow to be painted on one head of each reel pointing the opposite direction from the outer end of the cable with the words "Roll This Way" employing letters not less than 3/4 inch height and an arrow not less than six inches in length and 1/2 inch in width.
- I. Each reel to contain a weatherproof tag, firmly attached to the reel, showing the size of the conductor, type of conductor, number of feet, gross weight, type of jacketing, name of manufacturer, date of manufacture, and any other necessary identification.

PART 2 PRODUCTS

2.01 VITAL SIGNAL CABLE

- A. The signal cables (underground and aerial) to be furnished under this Contract to meet the requirements of Appendix TA-1, CTA Detail Specification for Vital Circuit Signal Wire and Cable, Specification No. CTA 497-00, with the following addenda:
1. Paragraph 2.3, Add "Gauge of conductors to be as specified within these Specifications."
 2. Paragraph 8.1, Add "A flat mil tape is not required for this project."
- B. Individual Conductors of Multiconductor Signal Cable
1. General Requirements
 - a. Single conductors and the individual conductors of multiconductor signal cables to be rated for continuous operation at 75 degrees C in wet or dry locations. The rated life to be 40 years.
 - b. Single Conductor Identification - The sheath of single conductor cables to be surface-printed with a legend identifying the manufacturer, year of manufacture, conductor size, and voltage rating in contrasting ink; durable surface colors are required.
- C. Assembly of Vital Signal Multi-Conductor Cables
1. Cable tape to conform to Section 4.4 of ICEA, except that compound-filled tape to be treated on both sides and thoroughly filled with a rubber compound. Where colored tapes are called for, the colors to be clear, durable, and of easily distinguishable shades; they to have no harmful effect on any part of the cable.
 2. Manufacturer's Identification Marker: A waterproofed marker tape bearing the name of the manufacturer and year of manufacture to be inserted in wires and cables for identification purposes. The identification marking to be placed at such intervals that all information may be obtained without destroying more than three feet of cable. This information to be inserted as follows:
 - a. Multiple-conductor cables to have the marker tape so located as to be readily identified.
 - b. For all cables not included in the above, the manufacturer's color tracer threads to be inserted between the conductor and the insulation or among the strands of a stranded conductor.
 - c. As an alternative to the marker tape or tracer threads, the information may be placed on the outer sheath by indented print.

2.02 VITAL TRAIN DETECTION AND SUPERVISORY CABLE

- A. Aerial signal cables for audio frequency train detection circuits between the wayside track circuit junction boxes and the houses to meet the requirements of Appendix TA-2, CTA Detail Specification Cable: Electric, Self-Supporting Train Detection, Copper, Polyethylene – PVC Insulated, Polyethylene Sheath with Integral Messenger (600 Volt Dc), Specification No. CTA 3174-93A, with the following addenda:
1. Paragraph 1, Delete "ON INVITATION TO BID" from the title.
 2. Paragraph 10.1, Delete this paragraph and add: "A waterproofed marker tape bearing the name of the manufacturer and year of manufacture to be inserted in wires and cables for identification purposes. The identification marking to be

placed at such intervals that all information may be obtained without destroying more than one foot of cable. This information to be inserted as follows:

- a. Multiple-conductor cables to have the marker tape so located as to be readily identified.
 - b. For all cables not included in the above, the manufacturer's color tracer threads to be inserted between the conductor and the insulation or among the strands of a stranded conductor.
 - c. As an alternative to the marker tape or tracer threads, the information may be placed on the outer sheath by indented print.
- B. Underground signal cables for audio frequency train detection circuits between the wayside track circuit junction boxes and the houses to meet the requirements of Appendix TA-2, CTA Detail Specification Cable: Electric, Self-Supporting Train Detection, Copper, Polyethylene – PVC Insulated, Polyethylene Sheath with Integral Messenger (600 Volt Dc), Specification No. CTA 3174-93A, with the following addenda:
1. Paragraph 1, Delete "ON INVITATION TO BID" from the title.
 2. Paragraph 2.1, Delete last three sentences which refer to the web and messenger assemblies. Web and messenger will not be required for the underground cable.
 3. Section 8, Polyethylene Sheath (Jacket) Delete this section and add:
"Polyethylene Jacket the jacket to be in accordance with AREMA Signal Manual Part 10.3.16.G, Type II for polyethylene jackets.
 4. Delete Section 9.
 5. Paragraph 10.1, Delete this paragraph and add: "A waterproofed marker tape bearing the name of the manufacturer and year of manufacture to be inserted in wires and cables for identification purposes. The identification marking to be placed at such intervals that all information may be obtained without destroying more than one foot of cable. This information to be inserted as follows:
 - a. Multiple-conductor cables to have the marker tape so located as to be readily identified.
 - b. For all cables not included in the above, the manufacturer's color tracer threads to be inserted between the conductor and the insulation or among the strands of a stranded conductor.
 - c. As an alternative to the marker tape or tracer threads, the information may be placed on the outer sheath by indented print.
 6. Delete Sections 11 and 12.
- C. Tunnel cables for audio frequency train detection between junction boxes and houses to be in accordance with these Specifications for low-smoke cable.

2.03 SIGNAL CABLE APPLICATION

- A. General:
1. The Contractor to be responsible for sizing of all conductors and cable makeup greater than specified due to application of his design. Increases in required conductor size to be in accordance with the National Electrical Code.
 2. Multiconductor Main Cable for Track Circuits and Supervisory:
 - a. These are the main express cables, comprised of twisted pairs, provided along the right-of-way between relay houses/rooms, and terminating in each track circuit junction box. This cable to contain the track circuits and the supervisory circuits.

- b. The number of conductors required between the relay houses/rooms to be determined by the Contractor, and to meet all of the following requirements:
 - 1) The track circuit/supervisory cables for the entire project to be one size, with the same number of conductors in each segment between relay houses/rooms. Different sized cables for each segment will not be allowed.
 - 2) 20 percent minimum spare conductor pairs to be provided in each segment.
 - 3) The number of pairs per cable to not be less than twelve.
 - c. Based upon the above three paragraphs, the Contractor to determine the number of working pairs required in each section between relay houses/rooms, determine the maximum of these values, and multiply the maximum by 1.2 to determine the minimum number of pairs to be provided for the track circuit/supervisory express cable for the entire length of the project.
 - d. AF track circuit cables to be terminated in junction boxes located within 250 feet of the impedance bond or receive point.
3. Main Cable for Line Circuits:
- a. These are the main express cables furnished along the right-of-way between relay houses/rooms for line circuits.
 - b. The number of conductors required between the relay houses/rooms to be determined by the Contractor, and to meet all of the following requirements:
 - 1) The line circuit cables for the entire project to be one size, with the same number of conductors in each segment between relay houses/rooms. Different sized cables for each segment will not be allowed.
 - 2) 20 percent minimum spare conductors to be provided in each segment.
 - 3) The cable to be a standard size of 19, 21, 27, or 37 conductors. Use of a cable with less than 19 conductors for the line circuits will not be allowed.
 - c. Based upon the above three paragraphs and the Contractor's final detail design, the Contractor to determine the number of working wires required in each section between relay houses/rooms, determine the maximum of these values, multiply the maximum by 1.2, and round up to 19, 21, 27, or 37 to determine the number of conductors to be provided for the line circuit cable for the entire length of the project. If more than 37 conductors are required, multiple cables to be provided.
 - d. Line circuit express cables to be terminated in track circuit junction boxes at an interval of no greater than every 1500 feet between interlockings, relay cases, relay houses, relay rooms, or other signal control locations. Minor deviations may be considered by the Engineer.
4. AF Track Circuit Connections:
- a. The cables provided for installation between track circuit junction boxes and the tuning units to be a single twisted pair 14 AWG.
 - b. AF track circuit cables between the express cable junction box and the impedance bond or receive point to not exceed 250 feet.

5. AC Track Circuit Connections:
 - a. The cables provided for installation between relay houses/rooms and the rails to be two separate twisted single conductors, 9 AWG. The two conductors to be twisted one turn per foot.
6. AF Loop Connections:
 - a. The cables provided for installation between relay house/rooms and the loop junction boxes to be a single twisted pair 14 AWG. The cables for the loops to be a single twisted pair 9 AWG, transposed every 50 feet (with a minimum of one transposition per loop).
7. Signal System to Train Arrival Cable
 - a. Cable to be 8 pair, 16 AWG, individually and overall shielded, 600V instrumentation cable constructed from stranded bare copper, PVC & nylon insulation, aluminum/mylar shields w/stranded tinned copper drain wires and an overall PVC jacket. Manufactured in accordance with UL STD. 1277 & NEC listed Type 'TC'. Cable may be installed in open air, in ducts or conduits, in trays or troughs and should be approved for direct burial and outdoor applications.
 - b. Jacket to be sun-light and oil resistant. Cable to be UL/TC-ER approved for 600V, 75 degree C wet or 90 degree C dry environments and meets or exceeds UL1581 and UL 1202 (FT-4) 70,000 BTU/hr and ICEA T-29-520 210,000 BTU/hr flame tests.
 - 1) Conductor: 16 AWG, Class B7 stranding, annealed bare copper.
 - 2) PVC & nylon insulation: Thickness 0.015" PVC and 0.005" nylon
 - 3) Color code: Black & White pairs
 - 4) Assembly: Pair/cable lay length: UL 1277
 - a) Pair Shield: Foil free edged aluminum / mylar tape
Drain wire: 18 AWG, 7 strand, tinned copper, per pair
Cable binder: Clear mylar tape
 - b) Cable shield: Aluminum mylar tape
 - c) Cable drain: 16 AWG, 7 strand tinned copper
 - d) Jacket: PVC per UL 1227, thickness = 0.060", diameter = 0.6489", color = black

PART 3 EXECUTION

3.01 CABLE INSTALLATION

A. General

1. The installation of wire and cable to conform to Part 10.4.1 of the AREMA Signal Manual, except as modified herein.
2. The Contractor to give the Engineer 24 hours notice prior to installing cables.
3. The Contractor to provide sufficient slack in cable conductors at all terminating posts to enable three re-terminations of the conductor due to broken eyelets without re-pothreading the cable.
4. In certain types of installation, the cable cannot be supported; therefore, ample cable slack to be provided for additional flexibility due to vibration of such equipment.
5. Cables to not be bent to a radius less than 10 times the outer diameter of the cable during installation or as specified by the cable manufacturer.
6. All cable runs to be continuous without splices between cable terminating locations.
7. Tags to identify cables to be of plastic material. Tags to be lettered to correspond with the cable destination and number of conductors in the cable. The type of tag to be used to be as described in the Miscellaneous Components and Products Section of these Specifications.
8. All cables to be terminated in conductor order. Individual cable conductors to be identified at each cable termination with plastic tags as specified in these Specifications. All spare conductors in each cable to be terminated and identified.
9. All cables to be adequately supported prior to entering the houses, rooms, towers, junction boxes, and cases to prevent undo forces on the wire terminals. Supporting devices to include Kellems grips, cable clamps, and other devices specifically manufactured to hold single cables and multiple cables without injuring the cable jackets.
10. All cable entrance openings in equipment enclosures and junction boxes to be sealed with either a compression type fitting or pliable sealing compound after the cable is in place. Sealing compound to be used to seal the area around cable where the cable emerges from the end of a conduit, pipe or duct bank. All spare and empty abandoned conduits to be sealed or plugged in an approved manner.
11. A suitable lubricating medium, noninjurious to the cable jacket, to be used when pulling cables into conduit, pipe, or duct bank.
12. Where cable transfers from trays or troughs to conduit the ends of the conduit to be fitted with end bells to prevent damage to the cable.
13. Wherever multiple conductor cables are terminated the outer sheath of the cable to be carefully removed to the point of cable entrance. At the end of the cable sheath or covering, two layers of plastic electrical tape to be applied.
14. All cables hung below or adjacent to structural steel to be installed above the height of the bottom of steel elevation to prevent any possible interference from vehicle traffic on the roads or on the sidewalks.

B. Duct Bank Installation:

1. The Contractor to establish the maximum allowable length of cable which may be safely pulled into each conduit after obtaining the cable manufacturer's recommendations regarding pulling limits for the cables. Consideration to be given to the following parameters: fill, friction, clearance, configurations, jam ratio for the cables and conduit, weight correction factor, bend radii, maximum allowable tension, sidewall load, and weight of the cables.
2. Each conduit to be used in conduit duct banks to be blown or swabbed dry and rodded and mandrelled.

3. Cables to be placed in the lowest available duct. All cables to be placed in one duct to be installed simultaneously. Extreme care must be used in installing cables so as to avoid twisting, kinking, or in any way injuring the cable or its sheath.
4. In pulling cable, an approved wire cable grip extending not less than 18 inches back from the end of the cable to be used and the clutch on the pulling device to be set to slip at 50 percent of the weight per 1000 feet of the cable to be pulled. The equipment used for pulling cable to be equipped with a dynamometer which to indicate the pulling force in pounds. The Contractor to monitor pulling tension throughout the pull and record the results.
5. Glycerized liquid lubricant or other approved lubricant to be applied to the cable as approved by the Engineer when installing cables in ducts.
6. The ends of the cable to be immediately sealed until such time as the contractor chooses to terminate the cable.
7. All conduits entering manholes or housings to be filled with sealing compound.
8. When necessary, the Contractor to pump water out of manholes, cable pits, and pull chambers before installing any cables and he to be responsible for maintaining manholes and pull chambers in a dry condition while the cables are being pulled.
9. Cable installation in conduit to not exceed 40-percent fill per conduit, unless otherwise allowed by the Engineer.
10. Cables installed in manholes and handholes to be properly constrained and fastened to the walls of the manhole in accordance with the approved installation drawings.
11. Provide cable slack in handholes the length of one complete turn around the inside perimeter of the handhole from entrance of cable to exit.

C. TESTS

1. All installed external cable to be field tested in accordance with requirements of the Signal System Tests Section of these Specifications.

END OF SECTION 37 84 00

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES

Revise Article 669.01 of the Standard Specifications to read:

“669.01 Description. This work shall consist of the transportation and proper disposal of contaminated soil and water. This work shall also consist of the removal, transportation, and proper disposal of underground storage tanks (UST), their content and associated underground piping to the point where the piping is above the ground, including determining the content types and estimated quantities.”

Revise Article 669.08 of the Standard Specifications to read:

“669.08 Contaminated Soil and/or Groundwater Monitoring. The Contractor shall hire a qualified environmental firm to monitor the area containing the regulated substances. The affected area shall be monitored with a photoionization detector (PID) utilizing a lamp of 10.6eV or greater or a flame ionization detector (FID). Any field screen reading on the PID or FID in excess of background levels indicates the potential presence of contaminated material requiring handling as a non-special waste, special waste, or hazardous waste. No excavated soils can be taken to a clean construction and demolition debris (CCDD) facility or an uncontaminated soil fill operation with detectable PID or FID meter readings that are above background. The PID or FID meter shall be calibrated on-site and background level readings taken and recorded daily. All testing shall be done by a qualified engineer/technician. Such testing and monitoring shall be included in the work. The Contractor shall identify the exact limits of removal of non-special waste, special waste, or hazardous waste. All limits shall be approved by the Engineer prior to excavation. The Contractor shall take all necessary precautions.

Based upon the land use history of the subject property and/or PID or FID readings indicating contamination, a soil or groundwater sample shall be taken from the same location and submitted to an approved laboratory. Soil or groundwater samples shall be analyzed for the contaminants of concern, including pH, based on the property's land use history or the parameters listed in the maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605. The analytical results shall serve to document the level of soil contamination. Soil and groundwater samples may be required at the discretion of the Engineer to verify the level of soil and groundwater contamination.

Samples shall be grab samples (not combined with other locations). The samples shall be taken with decontaminated or disposable instruments. The samples shall be placed in sealed containers and transported in an insulated container to the laboratory. The container shall maintain a temperature of 39 °F (4 °C). All samples shall be clearly labeled. The labels shall indicate the sample number, date sampled, location and elevation, and any other observations.

The laboratory shall use analytical methods which are able to meet the lowest appropriate practical quantitation limits (PQL) or estimated quantitation limit (EQL) specified in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water", EPA, EMSL, EPA-600/4-88/039. For parameters where the specified cleanup objective is below the acceptable detection limit (ADL), the ADL shall serve as the cleanup objective. For other parameters the ADL shall be equal to or below the specified cleanup objective."

Replace the first two paragraphs of Article 669.09 of the Standard Specifications with the following:

"669.09 Contaminated Soil and/or Groundwater Management and Disposal. The management and disposal of contaminated soil and/or groundwater shall be according to the following:

- (a) Soil Analytical Results Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels exceed the most stringent maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605, the soil shall be managed as follows:
 - (1) When analytical results indicate inorganic chemical constituents exceed the most stringent MAC but they are still considered within area background levels by the Engineer, the excavated soil can be utilized within the construction limits as fill, when suitable. Such soil excavated for storm sewers can be placed back into the excavated trench as backfill, when suitable, unless trench backfill is specified. If the soils cannot be utilized within the construction limits, they shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.
 - (2) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for a Metropolitan Statistical Area (MSA) County, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as "uncontaminated soil" at a CCDD facility or an uncontaminated soil fill operation within an MSA County provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (3) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, or the MAC within the Chicago corporate limits, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as "uncontaminated soil" at a CCDD facility or an uncontaminated soil fill operation within an MSA County excluding Chicago or within the Chicago corporate limits provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.

- (4) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County excluding Chicago provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
- (5) When the Engineer determines soil cannot be managed according to Articles 669.09(a)(1) through (a)(4) above, the soil shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.
- (b) Soil Analytical Results Do Not Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels do not exceed the most stringent MAC, the excavated soil can be utilized within the construction limits or managed and disposed of off-site as “uncontaminated soil” according to Article 202.03. However the excavated soil cannot be taken to a CCDD facility or an uncontaminated soil fill operation for the following reason.
- (1) The pH of the soil is less than 6.25 or greater than 9.0.
- (2) The soil exhibited elevated photoionization detector (PID) utilizing a lamp of 10.6eV or greater or a flame ionization detector (FID) readings.
- (c) Soil Analytical Results Exceed Most Stringent MAC but Do Not Exceed TACO Residential. When the soil analytical results indicate that detected levels exceed the most stringent MAC but do not exceed TACO Tier 1 Soil Remediation Objectives for Residential Properties pursuant to 35 IAC 742 Appendix B Table A, the excavated soil can be utilized within the right-of-way or managed and disposed of off-site as “uncontaminated soil” according to Article 202.03. However the excavated soil cannot be taken to a CCDD facility or an uncontaminated soil fill operation.
- (d) Groundwater. When groundwater analytical results indicate the detected levels are above Appendix B, Table E of 35 Illinois Administrative Code 742, the most stringent Tier 1 Groundwater Remediation Objectives for Groundwater Component of the Groundwater Ingestion Route for Class 1 groundwater, the groundwater shall be managed off-site as a special waste.

All groundwater encountered within lateral trenches may be managed within the trench and allowed to infiltrate back into the ground. If the groundwater cannot be managed within the trench it must be removed as a special or hazardous waste. The Contractor is prohibited from managing groundwater within the trench by discharging it through any existing or new storm sewer. The Contractor shall install backfill plugs within the area of groundwater contamination.

One backfill plug shall be placed down gradient to the area of groundwater contamination. Backfill plugs shall be installed at intervals not to exceed 50 ft (15 m). Backfill plugs are to be 4 ft (1.2 m) long, measured parallel to the trench, full trench width and depth. Backfill plugs shall not have any fine aggregate bedding or backfill, but shall be entirely cohesive soil or any class of concrete. The Contractor shall provide test data that the material has a permeability of less than 10^{-7} cm/sec according to ASTM D 5084, Method A or per another test method approved by the Engineer.”

Revise Article 669.14 of the Standard Specifications to read:

“669.14 Final Environmental Construction Report. At the end of the project, the Contractor will prepare and submit three copies of the Environmental Construction Report on the activities conducted during the life of the project, one copy shall be submitted to the Resident Engineer, one copy shall be submitted to the District's Environmental Studies Unit, and one copy shall be submitted with an electronic copy in Adode.pdf format to the Geologic and Waste Assessment Unit, Bureau of Design and Environment, IDOT, 2300 South Dirksen Parkway, Springfield, Illinois 62764. The technical report shall include all pertinent information regarding the project including, but not limited to:

- (a) Measures taken to identify, monitor, handle, and dispose of soil or groundwater containing regulated substances, to prevent further migration of regulated substances, and to protect workers,
- (b) Cost of identifying, monitoring, handling, and disposing of soil or groundwater containing regulated substances, the cost of preventing further migration of regulated substances, and the cost for worker protection from the regulated substances. All cost should be in the format of the contract pay items listed in the contract plans (identified by the preliminary environmental site assessment (PESA) site number),
- (c) Plan sheets showing the areas containing the regulated substances,
- (d) Field sampling and testing results used to identify the nature and extent of the regulated substances,
- (e) Waste manifests (identified by the preliminary environmental site assessment (PESA) site number) for special or hazardous waste disposal, and
- (f) Landfill tickets (identified by the preliminary environmental site assessment (PESA) site number) for non-special waste disposal.”

Revise the second paragraph of Article 669.16 of the Standard Specifications to read:

“The transportation and disposal of soil and other materials from an excavation determined to be contaminated will be paid for at the contract unit price per cubic yard (cubic meter) for NON-SPECIAL WASTE DISPOSAL, SPECIAL WASTE DISPOSAL, or HAZARDOUS WASTE DISPOSAL.”

Qualifications. The term environmental firm shall mean an environmental firm with at least five (5) documented leaking underground storage tank (LUST) cleanups or that is pre-qualified in hazardous waste by the Department. Documentation includes but not limited to verifying remediation and special waste operations for sites contaminated with gasoline, diesel, or waste oil in accordance with all Federal, State, or local regulatory requirements and shall be provided to the Engineer for approval. The environmental firm selected shall not be a former or current consultant or have any ties with any of the properties contained within and/or adjacent to this construction project.

General. This Special Provision will likely require the Contractor to subcontract for the execution of certain activities.

All contaminated materials shall be managed as either “uncontaminated soil” or non-special waste. This work shall include monitoring and potential sampling, analytical testing, and management of a material contaminated by regulated substances. The Environmental Firm shall continuously monitor all soil excavation for worker protection and soil contamination. **Phase I Preliminary Engineering information is available through the District's Environmental Studies Unit.** Soil samples or analysis without the approval of the Engineer will be at no additional cost to the Department. The lateral distance is measured from centerline and the farthest distance is the offset distance or construction limit whichever is less. [

The Contractor shall manage any excavated soils and sediment within the following areas:

- Station 3700+00 to Station 3701+00 0 to 100 feet RT (UIC Harrison Field, PESA Site 2515-225, 800 Block of South Harrison Street). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Benzo(k)Fluoranthene, Carbazole, Dibenzo(a,h)Anthracene, Indeno(1,2,3-cd)Pyrene, Naphthalene, and Lead.
- Station 3706+00 to Station 3707+00 0 to 70 feet RT (Downtown Cleaners and Olshaw's Interior Service, PESA Site 2515-210, 407 South Peoria Street). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Carbazole, Dibenzo(a,h)Anthracene, Indeno(1,2,3-cd)Pyrene, and Lead.
- Station 3701+00 to Station 3703+00 0 to 70 feet RT (UIC Harrison Field, PESA Site 2515-225, 800 Block of South Harrison Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Dibenzo(a,h)Anthracene, and Lead.
- Station 3700+00 to Station 3703+00 0 to 100 feet LT (UIC Parking Lot #9, PESA Site 2515-224, 521 South Morgan Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Dibenzo(a,h)Anthracene, Iron, and Lead.

- Station 3704+75 to Station 3707+00 0 to 70 feet RT (Mixed-Use Building, PESA Site 2515-211, 833-843 West Van Buren Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Pyrene, Lead, Manganese.
- Station 3704+75 to Station 3707+00 0 to 70 feet LT (UIC, PESA Site 2515-209, 400-412 South Peoria Street). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Benzo(a)Pyrene, Lead, and Manganese.

DRAINAGE SYSTEM

Effective : June 10, 1994

Revised: January 1, 2007

Description. This work shall consist of furnishing and installing a bridge drainage system as shown on the plans, including all piping, fittings, support brackets, inserts, bolts, and splash blocks when specified.

Material. The pipe and fittings shall be reinforced fiberglass according to ASTM D 2996 RTRP with a 30,000 psi (207 MPa) minimum short-time rupture strength hoop tensile stress. The reinforced fiberglass shall also have an apparent stiffness factor at 5 percent deflection exceeding 200 cu in.-lbf/sq. in. (22.6 cu mm-kPa) and a minimum wall thickness of 0.10 in. (2.54 mm). All pipe supports and associated hardware shall be hot dip galvanized according to AASHTO M 232 (M 232M). The fiberglass pipe and fittings furnished shall be pigmented through out, or have a resin-rich pigmented exterior coat, specifically designed for overcoating fiberglass, as recommended by the manufacturer. The color shall be as specified by the Engineer. The resin in either case shall have an ultraviolet absorber designed to prevent ultraviolet degradation. The supplier shall certify the material supplied meets or exceeds these requirements.

Design. The drainage system shall be designed as an open system with allowances for the differential expansion and contraction expected between the superstructure and the substructure to which the drainage system is attached.

Installation. All connections of pipes and fittings shown on the plans to facilitate future removal for maintenance cleanout or flushing shall be made with a threaded, gasketed coupler or a bolted gasketed flange system. Adhesive bonded joints will be permitted for runs of pipe between such connections. The end run connection shall feature a minimum nominal 6 in. (150 mm) female threaded fiberglass outlet. Straight runs may utilize a 45 degree reducing saddle bonded to the pipe. The female outlet shall be filled with a male threaded PVC plug.

Runs of pipe shall be supported at spacings not exceeding those recommended by the manufacturer of the pipe. Supports that have point contact or narrow supporting areas shall be avoided. Standard slings, clamps, clevis hangers and shoe supports designed for use with steel pipe may be used. A minimum strap width for hangers shall be 1 1/2 in. (40 mm) for all pipe under 12 in. (300 mm) in diameter and 2 in. (50 mm) for diameters 12 in. (300 mm) or greater. Straps shall have 120 degrees of contact with the pipe. Pipes supported on less than 120 degrees of contact shall have a split fiberglass pipe protective sleeve bonded in place with adhesive.

All reinforced fiberglass pipe, fittings, and expansion joints shall be handled and installed according to guidelines and procedures recommended by the manufacturer or supplier of the material.

Basis of Payment. This work will be paid for at the contract lump sum price for DRAINAGE SYSTEM.

PIPE UNDERDRAINS FOR STRUCTURES

Effective: May 17, 2000

Revised: January 22, 2010

Description. This work shall consist of furnishing and installing a pipe underdrain system as shown on the plans, as specified herein, and as directed by the Engineer.

Materials. Materials shall meet the requirements as set forth below:

The perforated pipe underdrain shall be according to Article 601.02 of the Standard Specifications. Outlet pipes or pipes connecting to a separate storm sewer system shall not be perforated.

The drainage aggregate shall be a combination of one or more of the following gradations, FA1, FA2, CA5, CA7, CA8, CA11, or CA13 thru 16, according to Sections 1003 and 1004 of the Standard Specifications.

The fabric surrounding the drainage aggregate shall be Geotechnical Fabric for French Drains according to Article 1080.05 of the Standard Specifications.

Construction Requirements. All work shall be according to the applicable requirements of Section 601 of the Standard Specifications except as modified below.

The pipe underdrains shall consist of a perforated pipe drain situated at the bottom of an area of drainage aggregate wrapped completely in geotechnical fabric and shall be installed to the lines and gradients as shown on the plans.

Method of Measurement. Pipe Underdrains for Structures shall be measured for payment in feet (meters), in place. Measurement shall be along the centerline of the pipe underdrains. All connectors, outlet pipes, elbows, and all other miscellaneous items shall be included in the measurement. Concrete headwalls shall be included in the cost of Pipe Underdrains for Structures, but shall not be included in the measurement for payment.

Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for PIPE UNDERDRAINS FOR STRUCTURES of the diameter specified. Furnishing and installation of the drainage aggregate, geotechnical fabric, forming holes in structural elements and any excavation required, will not be paid for separately, but shall be included in the cost of the pipe underdrains for structures.

GRANULAR BACKFILL FOR STRUCTURES

Effective: April 19, 2012
Revised: October 30, 2012

Revise Section 586 of the Standard Specifications to read:

SECTION 586. Granular Backfill for structures

586.01 Description. This work shall consist of furnishing, transporting and placing granular backfill for abutment structures.

586.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Fine Aggregate.....	1003.04
(b) Coarse Aggregates	1004.05

CONSTRUCTION REQUIREMENTS

586.03 General. This work shall be done according to Article 502.10 except as modified below. The backfill volume shall be backfilled, with granular material as specified in Article 586.02, to the required elevation as shown in the contract plans. The backfill volume shall be placed in convenient lifts for the full width to be backfilled. Unless otherwise specified in the contract plans, mechanical compaction will not be required. A deposit of gravel or crushed stone placed behind drain holes shall not be required. All drains not covered by geocomposite wall drains or other devices to prevent loss of backfill material shall be covered by sufficient filter fabric material meeting the requirements of Section 1080 and Section 282 with either 6 or 8 oz/sq yd (200 or 270 g/sq m) material allowed, with free edges overlapping the drain hole by at least 12 in. (300 mm) in all directions.

The granular backfill shall be brought to the finished grade as shown in the contract plans. When concrete is to be cast on top of the granular backfill, the Contractor, subject to approval of the Engineer, may prepare the top surface of the fill to receive the concrete as he/she deems necessary for satisfactory placement at no additional cost to the Department.

586.04 Method of Measurement. This work will be measured for payment as follows.

- (a) Contract Quantities. The requirements for the use of contract quantities shall conform to Article 202.07(a).
- (b) Measured Quantities. This work will be measured for payment in place and the volume computed in cubic yards (cubic meters). The volume will be determined by the method of average end areas behind the abutment.

586.05 Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) for GRANULAR BACKFILL FOR STRUCTURES.

COARSE AGGREGATE IN BRIDGE APPROACH SLABS/FOOTINGS (BDE)

Effective: April 1, 2012

Revised: April 1, 2013

Revise the third paragraph of Article 1004.01(b) of the Standard Specifications to read:

“Aggregates used in Class BS concrete (except when poured on subgrade), Class PS concrete, and Class PC concrete (bridge superstructure products only, excluding the approach slab) shall contain no more than two percent by weight (mass) of deleterious materials. Deleterious materials shall include substances whose disintegration is accompanied by an increase in volume which may cause spalling of the concrete.”

Revise the first sentence of the first paragraph of Article 1004.02(f) of the Standard Specifications to read:

- “(f) Freeze-Thaw Rating. When coarse aggregate is used to produce portland cement concrete for base course, base course widening, pavement (including precast), driveway pavement, sidewalk, shoulders, curb, gutter, combination curb and gutter, median, paved ditch, concrete superstructures on subgrade such as bridge approach slabs (excluding precast), concrete structures on subgrade such as bridge approach footings, or their repair using concrete, the gradation permitted will be determined from the results of the Department’s Freeze-Thaw Test (Illinois Modified AASHTO T 161).”

CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)

Effective: June 1, 2010

Revised: January 1, 2014

The reduction of emissions of particulate matter (PM) for off-road equipment shall be accomplished by installing retrofit emission control devices. The term “equipment” refers to diesel fuel powered devices rated at 50 hp and above, to be used on the jobsite in excess of seven calendar days over the course of the construction period on the jobsite (including rental equipment).

Contractor and subcontractor diesel powered off-road equipment assigned to the contract shall be retrofitted using the phased in approach shown below. Equipment that is of a model year older than the year given for that equipment’s respective horsepower range shall be retrofitted:

Effective Dates	Horsepower Range	Model Year
June 1, 2010 ^{1/}	600-749	2002
	750 and up	2006
June 1, 2011 ^{2/}	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006
June 1, 2012 ^{2/}	50-99	2004
	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006

1/ Effective dates apply to Contractor diesel powered off-road equipment assigned to the contract.

2/ Effective dates apply to Contractor and subcontractor diesel powered off-road equipment assigned to the contract.

The retrofit emission control devices shall achieve a minimum PM emission reduction of 50 percent and shall be:

- a) Included on the U.S. Environmental Protection Agency (USEPA) *Verified Retrofit Technology List* (<http://www.epa.gov/cleandiesel/verification/verif-list.htm>), or verified by the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>); or

- b) Retrofitted with a non-verified diesel retrofit emission control device if verified retrofit emission control devices are not available for equipment proposed to be used on the project, and if the Contractor has obtained a performance certification from the retrofit device manufacturer that the emission control device provides a minimum PM emission reduction of 50 percent.

Note: Large cranes (Crawler mounted cranes) which are responsible for critical lift operations are exempt from installing retrofit emission control devices if such devices adversely affect equipment operation.

Diesel powered off-road equipment with engine ratings of 50 hp and above, which are unable to be retrofitted with verified emission control devices or if performance certifications are not available which will achieve a minimum 50 percent PM reduction, may be granted a waiver by the Department if documentation is provided showing good faith efforts were made by the Contractor to retrofit the equipment.

Construction shall not proceed until the Contractor submits a certified list of the diesel powered off-road equipment that will be used, and as necessary, retrofitted with emission control devices. The list(s) shall include (1) the equipment number, type, make, Contractor/rental company name; and (2) the emission control devices make, model, USEPA or CARB verification number, or performance certification from the retrofit device manufacturer. Equipment reported as fitted with emissions control devices shall be made available to the Engineer for visual inspection of the device installation, prior to being used on the jobsite.

The Contractor shall submit an updated list of retrofitted off-road construction equipment as retrofitted equipment changes or comes on to the jobsite. The addition or deletion of any diesel powered equipment shall be included on the updated list.

If any diesel powered off-road equipment is found to be in non-compliance with any portion of this special provision, the Engineer will issue the Contractor a diesel retrofit deficiency deduction.

Any costs associated with retrofitting any diesel powered off-road equipment with emission control devices shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall not be grounds for a claim.

Diesel Retrofit Deficiency Deduction

When the Engineer determines that a diesel retrofit deficiency exists, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

The deficiency will be based on lack of diesel retrofit emissions control.

If a Contractor accumulates three diesel retrofit deficiency deductions for the same piece of equipment in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of the contract time, waiver of penalties, or be grounds for any claim.

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (BDE)

Effective: September 1, 2000

Revised: August 2, 2011

FEDERAL OBLIGATION. The Department of Transportation, as a recipient of federal financial assistance, is required to take all necessary and reasonable steps to ensure nondiscrimination in the award and administration of contracts. Consequently, the federal regulatory provisions of 49 CFR Part 26 apply to this contract concerning the utilization of disadvantaged business enterprises. For the purposes of this Special Provision, a disadvantaged business enterprise (DBE) means a business certified by the Department in accordance with the requirements of 49 CFR Part 26 and listed in the Illinois Unified Certification Program (IL UCP) DBE Directory.

STATE OBLIGATION. This Special Provision will also be used by the Department to satisfy the requirements of the Business Enterprise for Minorities, Females, and Persons with Disabilities Act, 30 ILCS 575. When this Special Provision is used to satisfy state law requirements on 100 percent state-funded contracts, the federal government has no involvement in such contracts (not a federal-aid contract) and no responsibility to oversee the implementation of this Special Provision by the Department on those contracts. DBE participation on 100 percent state-funded contracts will not be credited toward fulfilling the Department's annual overall DBE goal required by the US Department of Transportation to comply with the federal DBE program requirements.

CONTRACTOR ASSURANCE. The Contractor makes the following assurance and agrees to include the assurance in each subcontract that the Contractor signs with a subcontractor.

The Contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of contracts funded in whole or in part with federal or state funds. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate.

OVERALL GOAL SET FOR THE DEPARTMENT. As a requirement of compliance with 49 CFR Part 26, the Department has set an overall goal for DBE participation in its federally assisted contracts. That goal applies to all federal-aid funds the Department will expend in its federally assisted contracts for the subject reporting fiscal year. The Department is required to make a good faith effort to achieve the overall goal. The dollar amount paid to all approved DBE companies performing work called for in this contract is eligible to be credited toward fulfillment of the Department's overall goal.

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined that the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. The determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates that, in the absence of unlawful discrimination, and in an arena of fair and open competition, DBE companies can be expected to perform **20.00%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work. A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set for in this Special Provision:

- (a) The bidder documents that enough DBE participation has been obtained to meet the goal: or
- (b) The bidder documents that a good faith effort has been made to meet the goal, even though the effort did not succeed in obtaining enough DBE participation to meet the goal.

DBE LOCATOR REFERENCES. Bidders shall consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217)785-4611, or by visiting the Department's website at www.dot.il.gov.

BIDDING PROCEDURES. Compliance with this Special Provision is a material bidding requirement. The failure of the bidder to comply will render the bid not responsive.

- (a) The bidder shall submit a Disadvantaged Business Utilization Plan on Department forms SBE 2025 and 2026 with the bid.
- (b) The Utilization Plan shall indicate that the bidder either has obtained sufficient DBE participation commitments to meet the contract goal or has not obtained enough DBE participation commitments in spite of a good faith effort to meet the goal. The Utilization Plan shall further provide the name, telephone number, and telefax number of a responsible official of the bidder designated for purposes of notification of plan approval or disapproval under the procedures of this Special Provision.

- (c) The Utilization Plan shall include a DBE Participation Commitment Statement, Department form SBE 2025, for each DBE proposed for the performance of work to achieve the contract goal. For bidding purposes, submission of the completed SBE 2025 forms, signed by the DBEs and faxed to the bidder will be acceptable as long as the original is available and provided upon request. All elements of information indicated on the said form shall be provided, including but not limited to the following:
- (1) The names and addresses of DBE firms that will participate in the contract;
 - (2) A description, including pay item numbers, of the work each DBE will perform;
 - (3) The dollar amount of the participation of each DBE firm participating. The dollar amount of participation for identified work shall specifically state the quantity, unit price, and total subcontract price for the work to be completed by the DBE. If partial pay items are to be performed by the DBE, indicate the portion of each item, a unit price where appropriate and the subcontract price amount;
 - (4) DBE Participation Commitment Statements, form SBE 2025, signed by the bidder and each participating DBE firm documenting the commitment to use the DBE subcontractors whose participation is submitted to meet the contract goal;
 - (5) if the bidder is a joint venture comprised of DBE companies and non-DBE companies, the plan must also include a clear identification of the portion of the work to be performed by the DBE partner(s); and,
 - (6) If the contract goal is not met, evidence of good faith efforts.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan submitted by the apparent successful bidder is approved. All information submitted by the bidder must be complete, accurate and adequately document that enough DBE participation has been obtained or document that good faith efforts of the bidder, in the event enough DBE participation has not been obtained, before the Department will commit to the performance of the contract by the bidder. The Utilization Plan will be approved by the Department if the Utilization Plan documents sufficient commercially useful DBE work performance to meet the contract goal or the bidder submits sufficient documentation of a good faith effort to meet the contract goal pursuant to 49 CFR Part 26, Appendix A. The Utilization Plan will not be approved by the Department if the Utilization Plan does not document sufficient DBE participation to meet the contract goal unless the apparent successful bidder documented in the Utilization Plan that it made a good faith effort to meet the goal. This means that the bidder must show that all necessary and reasonable steps were taken to achieve the contract goal. Necessary and reasonable steps are those which, by their scope, intensity and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not successful. The Department will consider the quality, quantity, and intensity of the kinds of efforts that the bidder has made. Mere *pro forma* efforts, in other words, efforts done as a matter of form, are not good faith efforts; rather, the bidder is expected to have taken genuine efforts that would be reasonably expected of a bidder actively and aggressively trying to obtain DBE participation sufficient to meet the contract goal.

- (a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases, and will be considered by the Department.
- (1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.
 - (2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime Contractor might otherwise prefer to perform these work items with its own forces.
 - (3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
 - (4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.
 - b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable.

- (5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
 - (6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
 - (7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.
 - (8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.
- (b) If the Department determines that the apparent successful bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided that it is otherwise eligible for award. If the Department determines that the bidder has failed to meet the requirements of this Special Provision or that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification shall include a statement of reasons for the determination.
- (c) The bidder may request administrative reconsideration of a determination adverse to the bidder within the five working days after the receipt of the notification date of the determination by delivering the request to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764 (Telefax: (217)785-1524). Deposit of the request in the United States mail on or before the fifth business day shall not be deemed delivery. The determination shall become final if a request is not made and delivered. A request may provide additional written documentation and/or argument concerning the issues raised in the determination statement of reasons, provided the documentation and arguments address efforts made prior to submitting the bid. The request will be forwarded to the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person in order to consider all issues of documentation and whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for consideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

CALCULATING DBE PARTICIPATION. The Utilization Plan values represent work anticipated to be performed and paid for upon satisfactory completion. The Department is only able to count toward the achievement of the overall goal and the contract goal the value of payments made for the work actually performed by DBE companies. In addition, a DBE must perform a commercially useful function on the contract to be counted. A commercially useful function is generally performed when the DBE is responsible for the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The Department and Contractor are governed by the provisions of 49 CFR Part 26.55(c) on questions of commercially useful functions as it affects the work. Specific counting guidelines are provided in 49 CFR Part 26.55, the provisions of which govern over the summary contained herein.

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.
- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.
- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the prime Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:
 - (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
 - (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission is receives as a result of the lease arrangement.
- (e) DBE as a material supplier:
 - (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.
 - (2) 100 percent goal credit for the cost of materials of supplies obtained from a DBE manufacturer.

- (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a regular dealer or manufacturer.

CONTRACT COMPLIANCE. Compliance with this Special Provision is an essential part of the contract. The Department is prohibited by federal regulations from crediting the participation of a DBE included in the Utilization Plan toward either the contract goal or the Department's overall goal until the amount to be applied toward the goals has been paid to the DBE. The following administrative procedures and remedies govern the compliance by the Contractor with the contractual obligations established by the Utilization Plan. After approval of the Utilization Plan and award of the contract, the Utilization Plan and individual DBE Participation Statements become part of the contract. If the Contractor did not succeed in obtaining enough DBE participation to achieve the advertised contract goal, and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of DBE work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the amended contract goal. All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the Participation Statement.

- (a) NO AMENDMENT. No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be submitted to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764. Telephone number (217)785-4611. Telefax number (217)785-1524.
- (b) TERMINATION OR REPLACEMENT. The Contractor shall not terminate or replace a DBE listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in the Special Provision.
- (c) CHANGES TO WORK. Any deviation from the DBE condition-of-award or contract plans, specifications, or special provisions must be approved, in writing, by the Department as provided elsewhere in the Contract. The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract. Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of Subcontractor, Department form BC 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, then a new Request for Approval of Subcontractor shall not be required. However, the Contractor must document efforts to assure that the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.

(d) ALTERNATIVE WORK METHODS. In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals. Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:

- (1) That the replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award; or
- (2) That the DBE is aware that its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
- (3) That the DBE is not capable of performing the replacement work or has declined to perform the work at a reasonable competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.

(e) TERMINATION AND REPLACEMENT PROCEDURES. The Contractor shall not terminate or replace a DBE subcontractor listed in the approved Utilization Plan without prior written consent. This includes, but is not limited to, instances in which the Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Written consent will be granted only if the Bureau of Small Business Enterprises agrees, for reasons stated in its concurrence document, that the Contractor has good cause to terminate or replace the DBE firm. Before transmitting to the Bureau of Small Business Enterprises any request to terminate and/or substitute a DBE subcontractor, the Contractor shall give notice in writing to the DBE subcontractor, with a copy to the Bureau, of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor shall give the DBE five days to respond to the Contractor's notice. The DBE so notified shall advise the Bureau and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Bureau should not approve the Contractor's action. If required in a particular case as a matter of public necessity, the Bureau may provide a response period shorter than five days.

For purposes of this paragraph, good cause includes the following circumstances:

- (1) The listed DBE subcontractor fails or refuses to execute a written contract;
- (2) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the prime contractor;

- (3) The listed DBE subcontractor fails or refuses to meet the prime Contractor's reasonable, nondiscriminatory bond requirements;
- (4) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (5) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1,200 or applicable state law.
- (6) You have determined that the listed DBE subcontractor is not a responsible contractor;
- (7) The listed DBE subcontractor voluntarily withdraws from the projects and provides to you written notice of its withdrawal;
- (8) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (9) A DBE owner dies or becomes disabled with the result that the listed DBE contractor is unable to complete its work on the contract;
- (10) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the prime Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the prime Contractor can self-perform the work for which the DBE contractor was engaged or so that the prime Contractor can substitute another DBE or non-DBE contractor after contract award.

When a DBE is terminated, or fails to complete its work on the Contract for any reason the Contractor shall make a good faith effort to find another DBE to substitute for the original DBE to perform at least the same amount of work under the contract as the terminated DBE to the extent needed to meet the established Contract goal.

- (f) PAYMENT RECORDS. The Contractor shall maintain a record of payments for work performed to the DBE participants. The records shall be made available to the Department for inspection upon request. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than thirty calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Regional Engineer. If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes that the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the BDE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (h) of this part.
- (g) ENFORCEMENT. The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.
- (h) RECONSIDERATION. Notwithstanding any other provision of the contract, including but not limited to Article 109.09 of the Standard Specifications, the Contractor may request administrative reconsideration of a decision to deduct the amount of the goal not achieved as liquidated damages. A request to reconsider shall be delivered to the Contract Compliance Section and shall be handled and considered in the same manner as set forth in paragraph (c) of "Good Faith Effort Procedures" of this Special Provision, except a final decision that a good faith effort was not made during contract performance to achieve the goal agreed to in the Utilization Plan shall be the final administrative decision of the Department.

GRANULAR MATERIALS (BDE)

Effective: November 1, 2012

Revise the title of Article 1003.04 of the Standard Specifications to read:

“1003.04 Fine Aggregate for Bedding, Trench Backfill, Embankment, Porous Granular Backfill, Sand Backfill for Underdrains, and French Drains.”

Revise Article 1003.04(c) of the Standard Specifications to read:

“(c) Gradation. The fine aggregate gradations for granular embankment, granular backfill, bedding, and trench backfill for pipe culverts and storm sewers shall be FA 1, FA 2, or FA 6 through FA 21.

The fine aggregate gradation for porous granular embankment, porous granular backfill, french drains, and sand backfill for underdrains shall be FA 1, FA 2, or FA 20, except the percent passing the No. 200 (75 µm) sieve shall be 2±2.”

Revise Article 1004.05(c) of the Standard Specifications to read:

“(c) Gradation. The coarse aggregate gradations shall be as follows.

Application	Gradation
Blotter	CA 15
Granular Embankment, Granular Backfill, Bedding, and Trench Backfill for Pipe Culverts and Storm Sewers	CA 6, CA 9, CA 10, CA 12, CA17, CA18, and CA 19
Porous Granular Embankment, Porous Granular Backfill, and French Drains	CA 7, CA 8, CA 11, CA 15, CA 16 and CA 18”

HOT-MIX ASPHALT - DENSITY TESTING OF LONGITUDINAL JOINTS (BDE)

Effective: January 1, 2010

Revised: April 1, 2012

Description. This work shall consist of testing the density of longitudinal joints as part of the quality control/quality assurance (QC/QA) of hot-mix asphalt (HMA). Work shall be according to Section 1030 of the Standard Specifications except as follows.

Quality Control/Quality Assurance (QC/QA). Delete the second and third sentence of the third paragraph of Article 1030.05(d)(3) of the Standard Specifications.

Add the following paragraphs to the end of Article 1030.05(d)(3) of the Standard Specifications:

“Longitudinal joint density testing shall be performed at each random density test location. Longitudinal joint testing shall be located at a distance equal to the lift thickness or a minimum of 4 in. (100 mm), from each pavement edge. (i.e. for a 5 in. (125 mm) lift the near edge of the density gauge or core barrel shall be within 5 in. (125 mm) from the edge of pavement.) Longitudinal joint density testing shall be performed using either a correlated nuclear gauge or cores.

- a. Confined Edge. Each confined edge density shall be represented by a one-minute nuclear density reading or a core density and shall be included in the average of density readings or core densities taken across the mat which represents the Individual Test.
- b. Unconfined Edge. Each unconfined edge joint density shall be represented by an average of three one-minute density readings or a single core density at the given density test location and shall meet the density requirements specified herein. The three one-minute readings shall be spaced ten feet apart longitudinally along the unconfined pavement edge and centered at the random density test location.”

Revise the Density Control Limits table in Article 1030.05(d)(4) of the Standard Specifications to read:

“Mixture Composition	Parameter	Individual Test (includes confined edges)	Unconfined Edge Joint Density Minimum
IL-4.75	Ndesign = 50	93.0 – 97.4%	91.0%
IL-9.5, IL-12.5	Ndesign ≥ 90	92.0 – 96.0%	90.0%
IL-9.5,IL-9.5L, IL-12.5	Ndesign < 90	92.5 – 97.4%	90.0%
IL-19.0, IL-25.0	Ndesign ≥ 90	93.0 – 96.0%	90.0%
IL-19.0, IL-19.0L, IL-25.0	Ndesign < 90	93.0 – 97.4%	90.0%
SMA	Ndesign = 50 & 80	93.5 – 97.4%	91.0%
All Other	Ndesign = 30	93.0 - 97.4%	90.0%”

LRFD STORM SEWER BURIAL TABLES (BDE)

Effective: November 1, 2013

Revise Article 550.02 of the Standard Specifications to read as follows:

“Item	Article Section
(a) Clay Sewer Pipe	1040.02
(b) Extra Strength Clay Pipe	1040.02
(c) Concrete Sewer, Storm Drain, and Culvert Pipe	1042
(d) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe	1042
(e) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Note 1)	1042
(f) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Note 1)	1042
(g) Polyvinyl Chloride (PVC) Pipe	1040.03
(h) Corrugated Polyvinyl Chloride (PVC) Pipe with a Smooth Interior	1040.03
(i) Corrugated Polypropylene (CPP) Pipe with Smooth Interior	1040.07
(j) Rubber Gaskets and Preformed Flexible Joint Sealants for Concrete Pipe	1056
(k) Mastic Joint Sealer for Pipe	1055
(l) External Sealing Band	1057
(m) Fine Aggregate (Note 2)	1003.04
(n) Coarse Aggregate (Note 3)	1004.05
(o) Reinforcement Bars and Welded Wire Fabric	1006.10
(p) Handling Hole Plugs	1042.16
(q) Polyethylene (PE) Pipe with a Smooth Interior	1040.04
(r) Corrugated Polyethylene (PE) Pipe with a Smooth Interior	1040.04

Note 1. The class of elliptical and arch pipe used for various storm sewer sizes and heights of fill shall conform to the requirements for circular pipe.

Note 2. The fine aggregate shall be moist.

Note 3. The coarse aggregate shall be wet.”

Revise the table for permitted materials in Article 550.03 of the Standard Specifications as follows:

"Class	Materials
A	Rigid Pipes: Clay Sewer Pipe Extra Strength Clay Pipe Concrete Sewer, Storm Drain, and Culvert Pipe Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
B	Rigid Pipes: Clay Sewer Pipe Extra Strength Clay Pipe Concrete Sewer, Storm Drain, and Culvert Pipe Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe Flexible Pipes: Polyvinyl Chloride (PVC) Pipe Corrugated Polyvinyl Chloride Pipe (PVC) with a Smooth Interior Polyethylene (PE) Pipe with a Smooth Interior Corrugated Polyethylene (PE) Pipe with a Smooth Interior Corrugated Polypropylene (CPP) Pipe with a Smooth Interior"

Replace the storm sewers tables in Article 550.03 of the Standard Specifications with the following:

STORM SEWERS																
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED																
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE																
Nominal Diameter in.	Type 1								Type 2							
	Fill Height: 3' and less With 1' minimum cover								Fill Height: Greater than 3' not exceeding 10'							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
10	NA	3	X	X	X	X	X	NA	NA	1	*X	X	X	X	X	NA
12	IV	NA	X	X	X	X	X	X	II	1	*X	X	X	X	X	X
15	IV	NA	NA	X	X	NA	X	X	II	1	*X	X	X	NA	X	X
18	IV	NA	NA	X	X	X	X	X	II	2	X	X	X	X	X	X
21	III	NA	NA	X	X	NA	NA	NA	II	2	X	X	X	NA	NA	NA
24	III	NA	NA	X	X	X	X	X	II	2	X	X	X	X	X	X
27	III	NA	NA	NA	NA	NA	NA	NA	II	3	X	NA	NA	NA	NA	NA
30	IV	NA	NA	X	X	X	X	X	II	3	X	X	X	X	X	X
33	III	NA	NA	NA	NA	NA	NA	NA	II	NA	X	NA	NA	NA	NA	NA
36	III	NA	NA	X	X	X	X	X	II	NA	X	X	X	X	NA	X
42	II	NA	X	X	NA	X	X	NA	II	NA	X	X	NA	X	NA	NA
48	II	NA	X	X	NA	X	X	X	II	NA	X	X	NA	X	NA	NA
54	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
60	II	NA	NA	NA	NA	NA	NA	X	II	NA	NA	NA	NA	NA	NA	X
66	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
72	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
78	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
84	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
90	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
96	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
102	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
108	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA

- RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- CSP Concrete Sewer, Storm drain, and Culvert Pipe
- PVC Polyvinyl Chloride Pipe
- CPVC Corrugated Polyvinyl Chloride Pipe
- ESCP Extra Strength Clay Pipe
- PE Polyethylene Pipe with a Smooth Interior
- CPE Corrugated Polyethylene Pipe with a Smooth Interior
- CPP Corrugated Polypropylene pipe with a Smooth Interior
- X This material may be used for the given pipe diameter and fill height.
- NA This material is Not Acceptable for the given pipe diameter and fill height.
- * May also use Standard Strength Clay Pipe

STORM SEWERS (Metric)																
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED																
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE																
Nominal Diameter in.	Type 1								Type 2							
	Fill Height: 1 m' and less With 300 mm minimum cover								Fill Height: Greater than 1 m not exceeding 3 m							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
250	NA	3	X	X	X	X	X	NA	NA	1	*X	X	X	X	X	NA
300	IV	NA	X	X	X	X	X	X	II	1	*X	X	X	X	X	X
375	IV	NA	NA	X	X	NA	X	X	II	1	*X	X	X	NA	X	X
450	IV	NA	NA	X	X	X	X	X	II	2	X	X	X	X	X	X
525	III	NA	NA	X	X	NA	NA	NA	II	2	X	X	X	NA	NA	NA
600	III	NA	NA	X	X	X	X	X	II	2	X	X	X	X	X	X
675	III	NA	NA	NA	NA	NA	NA	NA	II	3	X	NA	NA	NA	NA	NA
750	IV	NA	NA	X	X	X	X	X	II	3	X	X	X	X	X	X
825	III	NA	NA	NA	NA	NA	NA	NA	II	NA	X	NA	NA	NA	NA	NA
900	III	NA	NA	X	X	X	X	X	II	NA	X	X	X	X	NA	X
1050	II	NA	X	X	NA	X	X	NA	II	NA	X	X	NA	X	NA	NA
1200	II	NA	X	X	NA	X	X	X	II	NA	X	X	NA	X	NA	NA
1350	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
1500	II	NA	NA	NA	NA	NA	NA	X	II	NA	NA	NA	NA	NA	NA	X
1650	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
1800	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
1950	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
2100	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
2250	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
2400	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
2550	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
2700	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA

- RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- CSP Concrete Sewer, Storm drain, and Culvert Pipe
- PVC Polyvinyl Chloride Pipe
- CPVC Corrugated Polyvinyl Chloride Pipe
- ESCP Extra Strength Clay Pipe
- PE Polyethylene Pipe with a Smooth Interior
- CPE Corrugated Polyethylene Pipe with a Smooth Interior
- CPP Corrugated Polypropylene pipe with a Smooth Interior
- X This material may be used for the given pipe diameter and fill height.
- NA This material is Not Acceptable for the given pipe diameter and fill height.
- * May also use Standard Strength Clay Pipe

STORM SEWERS KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE																
Nominal Diameter in.	Type 3								Type 4							
	Fill Height: Greater than 10' not exceeding 15'								Fill Height: Greater than 15' not exceeding 20'							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPP	
10	NA	2	X	X	X	X	X	NA	NA	3	X	X	X	X	NA	
12	III	2	X	X	X	X	NA	X	IV	NA	NA	X	X	X	NA	
15	III	3	X	X	X	NA	NA	X	IV	NA	NA	X	X	NA	X	
18	III	NA	X	X	X	X	NA	X	IV	NA	NA	X	X	X	NA	
21	III	NA	NA	X	X	NA	NA	NA	IV	NA	NA	X	X	NA	NA	
24	III	NA	NA	X	X	X	NA	NA	IV	NA	NA	X	X	X	NA	
27	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
30	III	NA	NA	X	X	X	NA	X	IV	NA	NA	X	X	X	NA	
33	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
36	III	NA	NA	X	X	X	NA	NA	IV	NA	NA	X	X	X	NA	
42	III	NA	NA	X	NA	X	NA	NA	IV	NA	NA	X	NA	X	NA	
48	III	NA	NA	X	NA	X	NA	NA	IV	NA	NA	X	NA	X	NA	
54	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
60	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
66	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
72	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
78	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
84	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
90	III	NA	NA	NA	NA	NA	NA	NA	1680	NA	NA	NA	NA	NA	NA	
96	III	NA	NA	NA	NA	NA	NA	NA	1690	NA	NA	NA	NA	NA	NA	
102	IV	NA	NA	NA	NA	NA	NA	NA	1700	NA	NA	NA	NA	NA	NA	
108	1360	NA	NA	NA	NA	NA	NA	NA	1710	NA	NA	NA	NA	NA	NA	

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

CSP Concrete Sewer, Storm drain, and Culvert Pipe

PVC Polyvinyl Chloride Pipe

CPVC Corrugated Polyvinyl Chloride Pipe

ESCP Extra Strength Clay Pipe

PE Polyethylene Pipe with a Smooth Interior

CPE Corrugated Polyethylene Pipe with a Smooth Interior

CPP Corrugated Polypropylene pipe with a Smooth Interior

X This material may be used for the given pipe diameter and fill height.

NA This material is Not Acceptable for the given pipe diameter and fill height.

* May also use Standard Strength Clay Pipe

Note RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the D-load to produce a 0.01 in crack.

STORM SEWERS (metric) KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE																
Nominal Diameter in.	Type 3								Type 4							
	Fill Height: Greater than 3 m not exceeding 4.5 m								Fill Height: Greater than 4.5 m not exceeding 6 m							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPP	
250	NA	2	X	X	X	X	X	NA	NA	3	X	X	X	X	NA	
300	III	2	X	X	X	X	NA	X	IV	NA	NA	X	X	X	NA	
375	III	3	X	X	X	NA	NA	X	IV	NA	NA	X	X	NA	X	
450	III	NA	X	X	X	X	NA	X	IV	NA	NA	X	X	X	NA	
525	III	NA	NA	X	X	NA	NA	NA	IV	NA	NA	X	X	NA	NA	
600	III	NA	NA	X	X	X	NA	NA	IV	NA	NA	X	X	X	NA	
675	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
750	III	NA	NA	X	X	X	NA	X	IV	NA	NA	X	X	X	NA	
825	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
900	III	NA	NA	X	X	X	NA	NA	IV	NA	NA	X	X	X	NA	
1050	III	NA	NA	X	NA	X	NA	NA	IV	NA	NA	X	NA	X	NA	
1200	III	NA	NA	X	NA	X	NA	NA	IV	NA	NA	X	NA	X	NA	
1350	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
1500	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
1650	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
1800	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
1950	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
2100	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	
2250	III	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	
2400	III	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	
2550	IV	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	
2700	70	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

CSP Concrete Sewer, Storm drain, and Culvert Pipe

PVC Polyvinyl Chloride Pipe

CPVC Corrugated Polyvinyl Chloride Pipe

ESCP Extra Strength Clay Pipe

PE Polyethylene Pipe with a Smooth Interior

CPE Corrugated Polyethylene Pipe with a Smooth Interior

CPP Corrugated Polypropylene pipe with a Smooth Interior

X This material may be used for the given pipe diameter and fill height.

NA This material is Not Acceptable for the given pipe diameter and fill height.

* May also use Standard Strength Clay Pipe

Note RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the metric D-load to produce a 25.4 micro-meter crack.

STORM SEWERS KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE								
Nominal Diameter in.	Type 5			Type 6			Type 7	
	Fill Height: Greater than 20' not exceeding 25'			Fill Height: Greater than 25' not exceeding 30'			Fill Height: Greater than 30' not exceeding 35'	
	RCCP	PVC	CPVC	RCCP	PVC	CPVC	RCCP	CPVC
10	NA	X	X	NA	X	X	NA	X
12	IV	X	X	V	X	X	V	X
15	IV	X	X	V	X	X	V	X
18	IV	X	X	V	X	X	V	X
21	IV	X	X	V	X	X	V	X
24	IV	X	X	V	X	X	V	X
27	IV	NA	NA	V	NA	NA	V	NA
30	IV	X	X	V	X	X	V	X
33	IV	NA	NA	V	NA	NA	V	NA
36	IV	X	X	V	X	X	V	X
42	IV	X	NA	V	X	NA	V	NA
48	IV	X	NA	V	X	NA	V	NA
54	IV	NA	NA	V	NA	NA	V	NA
60	IV	NA	NA	V	NA	NA	V	NA
66	IV	NA	NA	V	NA	NA	V	NA
72	V	NA	NA	V	NA	NA	V	NA
78	2020	NA	NA	2370	NA	NA	2730	NA
84	2020	NA	NA	2380	NA	NA	2740	NA
90	2030	NA	NA	2390	NA	NA	2750	NA
96	2040	NA	NA	2400	NA	NA	2750	NA
102	2050	NA	NA	2410	NA	NA	2760	NA
108	2060	NA	NA	2410	NA	NA	2770	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

PVC Polyvinyl Chloride Pipe

CPVC Corrugated Polyvinyl Chloride Pipe

ESCP Extra Strength Clay Pipe

X This material may be used for the given pipe diameter and fill height.

NA This material is Not Acceptable for the given pipe diameter and fill height.

Note RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the D-load to produce a 0.01 in crack.

STORM SEWERS (metric) KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE								
Nominal Diameter in.	Type 5			Type 6			Type 7	
	Fill Height: Greater than 20' not exceeding 25'			Fill Height: Greater than 25' not exceeding 30'			Fill Height: Greater than 30' not exceeding 35'	
	RCCP	PVC	CPVC	RCCP	PVC	CPVC	RCCP	CPVC
250	NA	X	X	NA	X	X	NA	X
300	IV	X	X	V	X	X	V	X
375	IV	X	X	V	X	X	V	X
450	IV	X	X	V	X	X	V	X
525	IV	X	X	V	X	X	V	X
600	IV	X	X	V	X	X	V	X
675	IV	NA	NA	V	NA	NA	V	NA
750	IV	X	X	V	X	X	V	X
825	IV	NA	NA	V	NA	NA	V	NA
900	IV	X	X	V	X	X	V	X
1050	IV	X	NA	V	X	NA	V	NA
1200	IV	X	NA	V	X	NA	V	NA
1350	IV	NA	NA	V	NA	NA	V	NA
1500	IV	NA	NA	V	NA	NA	V	NA
1650	IV	NA	NA	V	NA	NA	V	NA
1800	V	NA	NA	V	NA	NA	V	NA
1950	100	NA	NA	110	NA	NA	130	NA
2100	100	NA	NA	110	NA	NA	130	NA
2250	100	NA	NA	110	NA	NA	130	NA
2400	100	NA	NA	120	NA	NA	130	NA
2550	100	NA	NA	120	NA	NA	130	NA
2700	100	NA	NA	120	NA	NA	130	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

PVC Polyvinyl Chloride Pipe

CPVC Corrugated Polyvinyl Chloride Pipe

ESCP Extra Strength Clay Pipe

X This material may be used for the given pipe diameter and fill height.

NA This material is Not Acceptable for the given pipe diameter and fill height.

Note RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the metric D-load to produce a 25.4 micro-meter crack.

Revise the sixth paragraph of Article 550.06 of the Standard Specifications to read:

“PVC, PE and CPP pipes shall be joined according to the manufacturer’s specifications.”

Revise the first and second paragraphs of Article 550.08 of the Standard Specifications to read:

“550.08 Deflection Testing for Storm Sewers. All PVC, PE, and CPP storm sewers shall be tested for deflection not less than 30 days after the pipe is installed and the backfill compacted. The testing shall be performed in the presence of the Engineer.

For PVC, PE, and CPP storm sewers with diameters 24 in. (600 mm) or smaller, a mandrel drag shall be used for deflection testing. For PVC, PE, and CPP storm sewers with diameters over 24 in. (600 mm), deflection measurements other than by a mandrel shall be used.”

Revise the fifth paragraph of Article 550.08 to read as follows.

“The outside diameter of the mandrel shall be 95 percent of the base inside diameter. For all PVC pipe the base inside diameter shall be defined using ASTM D 3034 methodology. For all PE and CPP pipe, the base inside diameter shall be defined as the average inside diameter based on the minimum and maximum tolerances specified in the corresponding ASTM or AASHTO material specifications.”

Revise the first paragraph of Article 1040.03 of the Standard Specifications to read:

“1040.03 Polyvinyl Chloride (PVC) Pipe. Acceptance testing of PVC pipe and fittings shall be accomplished during the same construction season in which they are installed. The section properties shall be according to the manufacturer pre-submitted geometric properties on file with the Department. The manufacturer shall submit written certification that the material meets those properties. The pipe shall meet the following additional requirements.”

Delete Articles 1040.03(e) and (f) of the Standard Specifications.

Revise Articles 1040.04(c) and (d) of the Standard Specifications to read:

“(c) PE Profile Wall Pipe for Insertion Lining. The pipe shall be according to ASTM F 894. When used for insertion lining of pipe culverts, the pipe liner shall have a minimum pipe stiffness of 46 psi (317 kPa) at five percent deflection for nominal inside diameters of 42 in. (1050 mm) or less. For nominal inside diameters of greater than 42 in. (1050 mm), the pipe liner shall have a minimum pipe stiffness of 32.5 psi (225 kPa) at five percent deflection. All sizes shall have wall construction that presents essentially smooth internal and external surfaces.

(d) PE Pipe with a Smooth Interior. The pipe shall be according to ASTM F 714 (DR 32.5) with a minimum cell classification of PE 335434 as defined in ASTM D 3350. The section properties shall be according to the manufacturer pre-submitted geometric properties on file with the Department. The manufacturer shall submit written certification that the material meets those properties and the resin used to manufacture the pipe meets or exceeds the minimum cell classification requirements.”

Add the following to Section 1040 of the Standard Specifications:

“1040.08 Polypropylene (PP) Pipe. Storage and handling shall be according to the manufacturer's recommendations, except in no case shall the pipe be exposed to direct sunlight for more than six months. Acceptance testing of the pipe shall be accomplished during the same construction season in which it is installed. The section properties shall be according to the manufacturer pre-submitted geometric properties on file with the Department. The manufacturer shall submit written certification that the material meets those properties. The pipe shall meet the following additional requirements.

- (a) Corrugated PP Pipe with a Smooth Interior. The pipe shall be according to AAHSTO M 330 (nominal size – 12 to 60 in. (300 to 1500 mm)). The pipe shall be Type S or D.
- (b) Perforated Corrugated PP Pipe with A Smooth Interior. The pipe shall be according to AASHTO M 330 (nominal size – 12 to 60 in. (300 to 1500 mm)). The pipe shall be Type SP. In addition, the top centerline of the pipe shall be marked so that it is readily visible from the top of the trench before backfilling, and the upper ends of the slot perforations shall be a minimum of ten degrees below the horizontal.”

PAVEMENT MARKING FOR BIKE SYMBOL (BDE)

Effective: January 1, 2014

Add the following to the SYMBOLS table in Article 780.14 of the Standard Specifications:

“Symbol	Large Size sq ft (sq m)	Small Size Sq ft (sq m)
Bike Symbol	6.0 (0.56)	--“

PAYROLLS AND PAYROLL RECORDS (BDE)

Effective: January 1, 2014

FEDERAL AID CONTRACTS. Revise the following section of Check Sheet #1 of the Recurring Special Provisions to read:

“STATEMENTS AND PAYROLLS

The payroll records shall include the worker’s name, the worker’s address, the worker’s telephone number when available, the worker’s social security number, the worker’s classification or classifications, the worker’s gross and net wages paid in each pay period, the worker’s number of hours worked each day, the worker’s starting and ending times of work each day. However, any Contractor or subcontractor who remits contributions to a fringe benefit fund that is not jointly maintained and jointly governed by one or more employers and one or more labor organization must additionally submit the worker’s hourly wage rate, the worker’s hourly overtime wage rate, the worker’s hourly fringe benefit rates, the name and address of each fringe benefit fund, the plan sponsor of each fringe benefit, if applicable, and the plan administrator of each fringe benefit, if applicable.

The Contractor and each subcontractor shall submit payroll records to the Engineer each week from the start to the completion of their respective work, except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead, the payrolls shall include an identification number for each employee (e.g., the last four digits of the employee’s social security number). In addition, starting and ending times of work each day may be omitted from the payroll records submitted to the Engineer. The submittals shall be on the Department’s form SBE 48, or an approved facsimile. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate box (“No Work”, “Suspended”, or “Complete”) checked on the form.”

STATE CONTRACTS. Revise Section IV of Check Sheet #5 of the Recurring Special Provisions to read:

“IV.COMPLIANCE WITH THE PREVAILING WAGE ACT

1. **Prevailing Wages.** All wages paid by the Contractor and each subcontractor shall be in compliance with The Prevailing Wage Act (820 ILCS 130), as amended, except where a prevailing wage violates a federal law, order, or ruling, the rate conforming to the federal law, order, or ruling shall govern. The Contractor shall be responsible to notify each subcontractor of the wage rates set forth in this contract and any revisions thereto. If the Department of Labor revises the wage rates, the Contractor will not be allowed additional compensation on account of said revisions.

2. Payroll Records. The Contractor and each subcontractor shall make and keep, for a period of five years from the later of the date of final payment under the contract or completion of the contract, records of the wages paid to his/her workers. The payroll records shall include the worker's name, the worker's address, the worker's telephone number when available, the worker's social security number, the worker's classification or classifications, the worker's gross and net wages paid in each pay period, the worker's number of hours worked each day, the worker's starting and ending times of work each day. However, any contractor or subcontractor who remits contributions to a fringe benefit fund that is not jointly maintained and jointly governed by one or more employers and one or more labor organization must additionally submit the worker's hourly wage rate, the worker's hourly overtime wage rate, the worker's hourly fringe benefit rates, the name and address of each fringe benefit fund, the plan sponsor of each fringe benefit, if applicable, and the plan administrator of each fringe benefit, if applicable. Upon seven business days' notice, these records shall be available at a location within the State, during reasonable hours, for inspection by the Department or the Department of Labor; and Federal, State, or local law enforcement agencies and prosecutors.
3. Submission of Payroll Records. The Contractor and each subcontractor shall submit payroll records to the Engineer each week from the start to the completion of their respective work, except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall include an identification number for each employee (e.g., the last four digits of the employee's social security number). In addition, starting and ending times of work each day may be omitted from the payroll records submitted to the Engineer. The submittals shall be on the Department's form SBE 48, or an approved facsimile. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate box ("No Work", "Suspended", or "Complete") checked on the form.

Each submittal shall be accompanied by a statement signed by the Contractor or subcontractor, or an officer, employee, or officer thereof, which avers that: (i) he or she has examined the records and such records are true and accurate; (ii) the hourly rate paid to each worker is not less than the general prevailing rate of hourly wages required by the Act; and (iii) the Contractor or subcontractor is aware that filing a payroll record that he/she knows to be false is a Class A misdemeanor.

4. Employee Interviews. The Contractor and each subcontractor shall permit his/her employees to be interviewed on the job, during working hours, by compliance investigators of the Department or the Department of Labor."

PORTLAND CEMENT CONCRETE – CURING OF ABUTMENTS AND PIERS (BDE)

Effective: January 1, 2014

Revise Note 7/ of the Index Table of Curing and Protection of Concrete Construction of Article 1020.13 of the Standard Specifications to read:

“7/ Asphalt emulsion for waterproofing may be used in lieu of other curing methods when specified and permitted according to Article 503.18. The top surfaces of abutments and piers shall be cured according to Article 1020.13(a)(3) or (5).”

PORTLAND CEMENT CONCRETE EQUIPMENT (BDE)

Effective: November 1, 2013

Add the following to the first paragraph of Article 1103.03(a)(5) of the Standard Specifications to read:

“As an alternative to a locking key, the start and finish time for mixing may be automatically printed on the batch ticket. The start and finish time shall be reported to the nearest second.”

PROGRESS PAYMENTS (BDE)

Effective: November 2, 2013

Revise Article 109.07(a) of the Standard Specifications to read:

“(a) Progress Payments. At least once each month, the Engineer will make a written estimate of the quantity of work performed in accordance with the contract, and the value thereof at the contract unit prices. The amount of the estimate approved as due for payment will be vouchered by the Department and presented to the State Comptroller for payment. No amount less than \$1000.00 will be approved for payment other than the final payment.

Progress payments may be reduced by liens filed pursuant to Section 23(c) of the Mechanics' Lien Act, 770 ILCS 60/23(c).

If a Contractor or subcontractor has defaulted on a loan issued under the Department's Disadvantaged Business Revolving Loan Program (20 ILCS 2705/2705-610), progress payments may be reduced pursuant to the terms of that loan agreement. In such cases, the amount of the estimate related to the work performed by the Contractor or subcontractor, in default of the loan agreement, will be offset, in whole or in part, and vouchered by the Department to the Working Capital Revolving Fund or designated escrow account. Payment for the work shall be considered as issued and received by the Contractor or subcontractor on the date of the offset voucher. Further, the amount of the offset voucher shall be a credit against the Department's obligation to pay the Contractor, the Contractor's obligation to pay the subcontractor, and the Contractor's or subcontractor's total loan indebtedness to the Department. The offset shall continue until such time as the entire loan indebtedness is satisfied. The Department will notify the Contractor and Fund Control Agent in a timely manner of such offset. The Contractor or subcontractor shall not be entitled to additional payment in consideration of the offset.

The failure to perform any requirement, obligation, or term of the contract by the Contractor shall be reason for withholding any progress payments until the Department determines that compliance has been achieved."

QUALITY CONTROL/QUALITY ASSURANCE OF CONCRETE MIXTURES (BDE)

Effective: January 1, 2012

Revised: January 1, 2014

Revise Note 7/ of Schedule B of Recurring Special Provision Check Sheet #31 of the Standard Specifications to read:

- 7/ The test of record for strength shall be the day indicated in Article 1020.04. For cement aggregate mixture II, a strength requirement is not specified and testing is not required. Additional strength testing to determine early falsework and form removal, early pavement or bridge opening to traffic, or to monitor strengths is at the discretion of the Contractor. Strength shall be defined as the average of two 6 x 12 in. (150 x 300 mm) cylinder breaks, three 4 x 8 in. (100 x 200 mm) cylinder breaks, or two beam breaks for field tests. Per Illinois Modified AASHTO T 23, cylinders shall be 6 x 12 in. (150 x 300 mm) when the nominal maximum size of the coarse aggregate exceeds 1 in. (25 mm).

REINFORCEMENT BARS (BDE)

Effective: November 1, 2013

Revise the first and second paragraphs of Article 508.05 of the Standard Specifications to read:

“508.05 Placing and Securing. All reinforcement bars shall be placed and tied securely at the locations and in the configuration shown on the plans prior to the placement of concrete. Manual welding of reinforcement may only be permitted on precast concrete products as indicated in the current Bureau of Materials and Physical Research Policy Memorandum “Quality Control / Quality Assurance Program for Precast Concrete Products”, and for precast prestressed concrete products as indicated in the Department’s current “Manual for Fabrication of Precast Prestressed Concrete Products”. Reinforcement bars shall not be placed by sticking or floating into place or immediately after placement of the concrete.

Bars shall be tied at all intersections, except where the center to center dimension is less than 1 ft (300 mm) in each direction, in which case alternate intersections shall be tied. Molded plastic clips may be used in lieu of wire to secure bar intersections, but shall not be permitted in horizontal bar mats subject to construction foot traffic or to secure longitudinal bar laps. Plastic clips shall adequately secure the reinforcement bars, and shall permit the concrete to flow through and fully encase the reinforcement. Plastic clips may be recycled plastic, and shall meet the approval of the Engineer. The number of ties as specified shall be doubled for lap splices at the stage construction line of concrete bridge decks when traffic is allowed on the first completed stage during the pouring of the second stage.”

Revise the fifth paragraph of Article 508.05 of the Standard Specifications to read:

“Supports for reinforcement in bridge decks shall be metal. For all other concrete construction the supports shall be metal or plastic. Metal bar supports shall be made of cold-drawn wire, or other approved material and shall be either epoxy coated, galvanized or plastic tipped. When the reinforcement bars are epoxy coated, the metal supports shall be epoxy coated. Plastic supports may be recycled plastic. Supports shall be provided in sufficient number and spaced to provide the required clearances. Supports shall adequately support the reinforcement bars, and shall permit the concrete to flow through and fully encase the reinforcement. The legs of supports shall be spaced to allow an opening that is a minimum 1.33 times the nominal maximum aggregate size used in the concrete. Nominal maximum aggregate size is defined as the largest sieve which retains any of the aggregate sample particles. All supports shall meet the approval of the Engineer.”

Revise the first sentence of the eighth paragraph of Article 508.05 of the Standard Specifications to read:

“Epoxy coated reinforcement bars shall be tied with plastic coated wire, epoxy coated wire, or molded plastic clips where allowed.”

Add the following sentence to the end of the first paragraph of Article 508.06(c) of the Standard Specifications:

“In addition, the total slip of the bars within the splice sleeve of the connector after loading in tension to 30 ksi (207 MPa) and relaxing to 3 ksi (20.7 MPa) shall not exceed 0.01 in. (254 microns).”

Revise Article 1042.03(d) of the Standard Specifications to read:

“(d) Reinforcement and Accessories: The concrete cover over all reinforcement shall be within $\pm 1/4$ in. (± 6 mm) of the specified cover.

Welded wire fabric shall be accurately bent and tied in place.

Miscellaneous accessories to be cast into the concrete or for forming holes and recesses shall be carefully located and rigidly held in place by bolts, clamps, or other effective means. If paper tubes are used for vertical dowel holes, or other vertical holes which require grouting, they shall be removed before transportation to the construction site.”

REMOVAL AND DISPOSAL OF SURPLUS MATERIALS (BDE)

Effective: November 2, 2012

Revise the first four paragraphs of Article 202.03 of the Standard Specifications to read:

“202.03 Removal and Disposal of Surplus, Unstable, Unsuitable, and Organic Materials. Suitable excavated materials shall not be wasted without permission of the Engineer. The Contractor shall dispose of all surplus, unstable, unsuitable, and organic materials, in such a manner that public or private property will not be damaged or endangered.

Suitable earth, stones and boulders naturally occurring within the right-of-way may be placed in fills or embankments in lifts and compacted according to Section 205. Broken concrete without protruding metal bars, bricks, rock, stone, reclaimed asphalt pavement with no expansive aggregate, or uncontaminated dirt and sand generated from construction or demolition activities may be used in embankment or in fill. If used in fills or embankments, these materials shall be placed and compacted to the satisfaction of the Engineer; shall be buried under a minimum of 2 ft (600 mm) of earth cover (except when the materials include only uncontaminated dirt); and shall not create an unsightly appearance or detract from the natural topographic features of an area. Broken concrete without protruding metal bars, bricks, rock, or stone may be used as riprap as approved by the Engineer. If the materials are used for fill in locations within the right-of-way but outside project construction limits, the Contractor must specify to the Engineer, in writing, how the landscape restoration of the fill areas will be accomplished. Placement of fill in such areas shall not commence until the Contractor's landscape restoration plan is approved by the Engineer.

Aside from the materials listed above, all other construction and demolition debris or waste shall be disposed of in a licensed landfill, recycled, reused, or otherwise disposed of as allowed by State or Federal laws and regulations. When the Contractor chooses to dispose of uncontaminated soil at a clean construction and demolition debris (CCDD) facility or at an uncontaminated soil fill operation, it shall be the Contractor's responsibility to have the pH of the material tested to ensure the value is between 6.25 and 9.0, inclusive. A copy of the pH test results shall be provided to the Engineer.

A permit shall be obtained from IEPA and made available to the Engineer prior to open burning of organic materials (i.e., plant refuse resulting from pruning or removal of trees or shrubs) or other construction or demolition debris. Organic materials originating within the right-of-way limits may be chipped or shredded and placed as mulch around landscape plantings within the right-of-way when approved by the Engineer. Chipped or shredded material to be placed as mulch shall not exceed a depth of 6 in. (150 mm)."

TRACKING THE USE OF PESTICIDES (BDE)

Effective: August 1, 2012

Add the following paragraph after the first paragraph of Article 107.23 of the Standard Specifications:

"Within 48 hours of the application of pesticides, including but not limited to herbicides, insecticides, algacides, and fungicides, the Contractor shall complete and return to the Engineer, Operations form "OPER 2720"."

TRAFFIC CONTROL SETUP AND REMOVAL FREEWAY/EXPRESSWAY (BDE)

Effective: January 1, 2014

Add the following to the Article 701.18 of the Standard Specifications:

"(l) Standard 701428. When the shoulder width will not allow placement of the shoulder truck and provide 9 ft (3.0 m) of unobstructed lane width in the lane being closed, the shoulder truck shall not be used."

Revise Article 701.19(a) of the Standard Specifications to read:

"(a) Not Measured. Traffic control and protection required under Standards 701001, 701006, 701011, 701101, 701106, 701301, 701311, 701400, 701426, 701427, and 701428 will not be measured for payment."

TRAINING SPECIAL PROVISIONS (BDE)

Effective: October 15, 1975

This Training Special Provision supersedes Section 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities," and is in implementation of 23 U.S.C. 140(a).

As part of the Contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. The number of trainees to be trained under this contract will be 5. In the event the Contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also insure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within the reasonable area of recruitment. Prior to commencing construction, the Contractor shall submit to the Illinois Department of Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority trainees and women (e.g. by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used, the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by the Illinois Department of Transportation and the Federal Highway Administration. The Illinois Department of Transportation and the Federal Highway Administration shall approve a program, if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved by not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Illinois Department of Transportation and the Federal Highway Administration. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee's wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirement of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program.

It is not required that all trainees be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The Contractor shall furnish the trainee a copy of the program he will follow in providing the training. The Contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The Contractor shall provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

Method of Measurement. The unit of measurement is in hours.

Basis of Payment. This work will be paid for at the contract unit price of 80 cents per hour for TRAINEES. The estimated total number of hours, unit price, and total price have been included in the schedule of prices.

IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION (TPG)

Effective: August 1, 2012

Revised: February 1, 2014

In addition to the Contractor's equal employment opportunity affirmative action efforts undertaken as elsewhere required by this Contract, the Contractor is encouraged to participate in the incentive program to provide additional on-the-job training to certified graduates of IDOT funded pre-apprenticeship training programs outlined by this Special Provision.

It is the policy of IDOT to fund IDOT pre-apprenticeship training programs throughout Illinois to provide training and skill-improvement opportunities to assure the increased participation of minority groups, disadvantaged persons and women in all phases of the highway construction industry. The intent of this IDOT Training Program Graduate (TPG) Special Provision is to place certified graduates of these IDOT funded pre-apprentice training programs on IDOT project sites when feasible, and provide the graduates with meaningful on-the-job training intended to lead to journey-level employment. IDOT and its sub-recipients, in carrying out the responsibilities of a state contract, shall determine which construction contracts shall include "Training Program Graduate Special Provisions." To benefit from the incentives to encourage the participation in the additional on-the-job training under this Training Program Graduate Special Provision, the Contractor shall make every reasonable effort to employ certified graduates of IDOT funded Pre-apprenticeship Training Programs to the extent such persons are available within a reasonable recruitment area.

Participation pursuant to IDOT's requirements by the Contractor or subcontractor in this Training Program Graduate (TPG) Special Provision entitles the Contractor or subcontractor to be reimbursed at \$15.00 per hour for training given a certified TPG on this contract. As approved by the Department, reimbursement will be made for training persons as specified herein. This reimbursement will be made even though the Contractor or subcontractor may receive additional training program funds from other sources for other trainees, provided such other source does not specifically prohibit the Contractor or subcontractor from receiving other reimbursement. For purposes of this Special Provision the Contractor is not relieved of requirements under applicable federal law, the Illinois Prevailing Wage Act, and is not eligible for other training fund reimbursements in addition to the Training Program Graduate (TPG) Special Provision reimbursement.

No payment shall be made to the Contractor if the Contractor or subcontractor fails to provide the required training. It is normally expected that a TPG will begin training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project through completion of the contract, so long as training opportunities exist in his work classification or until he has completed his training program. Should the TPG's employment end in advance of the completion of the contract, the Contractor shall promptly notify the designated IDOT staff member under this Special Provision that the TPG's involvement in the contract has ended and supply a written report of the reason for the end of the involvement, the hours completed by the TPG under the Contract and the number of hours for which the incentive payment provided under this Special Provision will be or has been claimed for the TPG.

The Contractor will provide for the maintenance of records and furnish periodic reports documenting its performance under this Special Provision.

METHOD OF MEASUREMENT: The unit of measurement is in hours.

BASIS OF PAYMENT: This work will be paid for at the contract unit price of \$15.00 per hour for certified TRAINEES TRAINING PROGRAM GRADUATE. The estimated total number of hours, unit price and total price have been included in the schedule of prices.

The Contractor shall provide training opportunities aimed at developing full journeyworker in the type of trade or job classification involved. The initial number of TPGs for which the incentive is available under this contract is 5. During the course of performance of the Contract the Contractor may seek approval from the Department for additional incentive eligible TPGs. In the event the Contractor subcontracts a portion of the contract work, it shall determine how many, if any, of the TPGs are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this Special Provision. The Contractor shall also insure that this Training Program Graduate Special Provision is made applicable to such subcontract if the TPGs are to be trained by a subcontractor and that the incentive payment is passed on to each subcontractor.

For the Contractor to meet the obligations for participation in this TPG incentive program under this Special Provision, the Department has contracted with several entities to provide screening, tutoring and pre-training to individuals interested in working in the applicable construction classification and has certified those students who have successfully completed the program and are eligible to be TPGs. A designated IDOT staff member, the Director of the Office of Business and Workforce Diversity (OBWD), will be responsible for providing assistance and referrals to the Contractor for the applicable TPGs. For this contract, the Director of OBWD is designated as the responsible IDOT staff member to provide the assistance and referral services related to the placement for this Special Provision. For purposes of this Contract, contacting the Director of OBWD and interviewing each candidate he/she recommends constitutes reasonable recruitment.

Prior to commencing construction, the Contractor shall submit to the Department for approval the TPGs to be trained in each selected classification. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. No employee shall be employed as a TPG in any classification in which he/she has successfully completed a training course leading to journeyman status or in which he/she has been employed as a journeyman. Notwithstanding the on-the-job training purpose of this TPG Special Provision, some offsite training is permissible as long as the offsite training is an integral part of the work of the contract and does not comprise a significant part of the overall training.

Training and upgrading of TPGs of IDOT pre-apprentice training programs is intended to move said TPGs toward journeyman status and is the primary objective of this Training Program Graduate Special Provision. Accordingly, the Contractor shall make every effort to enroll TPGs by recruitment through the IDOT funded TPG programs to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps that it has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance and entitled to the Training Program Graduate Special Provision \$15.00 an hour incentive.

The Contractor or subcontractor shall provide each TPG with a certificate showing the type and length of training satisfactorily completed.

WARM MIX ASPHALT (BDE)

Effective: January 1, 2012

Revised: November 1, 2013

Description. This work shall consist of designing, producing and constructing Warm Mix Asphalt (WMA) in lieu of Hot Mix Asphalt (HMA) at the Contractor's option. Work shall be according to Sections 406, 407, 408, 1030, and 1102 of the Standard Specifications, except as modified herein. In addition, any references to HMA in the Standard Specifications, or the special provisions shall be construed to include WMA.

WMA is an asphalt mixture which can be produced at temperatures lower than allowed for HMA utilizing approved WMA technologies. WMA technologies are defined as the use of additives or processes which allow a reduction in the temperatures at which HMA mixes are produced and placed. WMA is produced by the use of additives, a water foaming process, or combination of both. Additives include minerals, chemicals or organics incorporated into the asphalt binder stream in a dedicated delivery system. The process of foaming injects water into the asphalt binder stream, just prior to incorporation of the asphalt binder with the aggregate.

Approved WMA technologies may also be used in HMA provided all the requirements specified herein, with the exception of temperature, are met. However, asphalt mixtures produced at temperatures in excess of 275 °F (135 °C) will not be considered WMA when determining the grade reduction of the virgin asphalt binder grade.

Materials.

Add the following to Article 1030.02 of the Standard Specifications.

“(h) Warm Mix Asphalt (WMA) Technologies (Note 3)”

Add the following note to Article 1030.02 of the Standard Specifications.

“Note 3. Warm mix additives or foaming processes shall be selected from the current Bureau of Materials and Physical Research Approved List, “Warm-Mix Asphalt Technologies”.”

Equipment.

Revise the first paragraph of Article 1102.01 of the Standard Specifications to read:

“**1102.01 Hot-Mix Asphalt Plant.** The hot-mix asphalt (HMA) plant shall be the batch-type, continuous-type, or dryer drum plant. The plants shall be evaluated for prequalification rating and approval to produce HMA according to the current Bureau of Materials and Physical Research Policy Memorandum, “Approval of Hot-Mix Asphalt Plants and Equipment”. Once approved, the Contractor shall notify the Bureau of Materials and Physical Research to obtain approval of all plant modifications. The plants shall not be used to produce mixtures concurrently for more than one project or for private work unless permission is granted in writing by the Engineer. The plant units shall be so designed, coordinated and operated that they will function properly and produce HMA having uniform temperatures and compositions within the tolerances specified. The plant units shall meet the following requirements.”

Add the following to Article 1102.01(a) of the Standard Specifications.

“(13) Equipment for Warm Mix Technologies.

- a. Foaming. Metering equipment for foamed asphalt shall have an accuracy of ± 2 percent of the actual water metered. The foaming control system shall be electronically interfaced with the asphalt binder meter.

- b. Additives. Additives shall be introduced into the plant according to the supplier's recommendations and shall be approved by the Engineer. The system for introducing the WMA additive shall be interlocked with the aggregate feed or weigh system to maintain correct proportions for all rates of production and batch sizes."

Mix Design Verification.

Add the following to Article 1030.04 of the Standard Specifications.

"(e) Warm Mix Technologies.

- (1) Foaming. WMA mix design verification will not be required when foaming technology is used alone (without WMA additives). However, the foaming technology shall only be used on HMA designs previously approved by the Department.
- (2) Additives. WMA mix designs utilizing additives shall be submitted to the Engineer for mix design verification.

Production.

Revise the second paragraph of Article 1030.06(a) of the Standard Specifications to read:

"At the start of mix production for HMA, WMA, and HMA using WMA technologies, QC/QA mixture start-up will be required for the following situations; at the beginning of production of a new mixture design, at the beginning of each production season, and at every plant utilized to produce mixtures, regardless of the mix."

Quality Control/Quality Assurance Testing.

Revise the table in Article 1030.05(d)(2)a. of the Standard Specifications to read:

Parameter	Frequency of Tests		Test Method See Manual of Test Procedures for Materials
	High ESAL Mixture Low ESAL Mixture	All Other Mixtures	
Aggregate Gradation % passing sieves: 1/2 in. (12.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 30 (600 μm) No. 200 (75 μm) Note 1.	1 washed ignition oven test on the mix per half day of production Note 4.	1 washed ignition oven test on the mix per day of production Note 4.	Illinois Procedure
Asphalt Binder Content by Ignition Oven Note 2.	1 per half day of production	1 per day	Illinois-Modified AASHTO T 308
VMA Note 3.	Day's production ≥ 1200 tons: 1 per half day of production Day's production < 1200 tons: 1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)	N/A	Illinois-Modified AASHTO R 35
Air Voids Bulk Specific Gravity of Gyratory Sample Note 5.	Day's production ≥ 1200 tons: 1 per half day of production Day's production < 1200 tons: 1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)	1 per day	Illinois-Modified AASHTO T 312
Maximum Specific Gravity of Mixture	Day's production ≥ 1200 tons: 1 per half day of production Day's production < 1200 tons: 1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)	1 per day	Illinois-Modified AASHTO T 209

Note 1. The No. 8 (2.36 mm) and No. 30 (600 μ m) sieves are not required for All Other Mixtures.

Note 2. The Engineer may waive the ignition oven requirement for asphalt binder content if the aggregates to be used are known to have ignition asphalt binder content calibration factors which exceed 1.5 percent. If the ignition oven requirement is waived, other Department approved methods shall be used to determine the asphalt binder content.

Note 3. The G_{sb} used in the voids in the mineral aggregate (VMA) calculation shall be the same average G_{sb} value listed in the mix design.

Note 4. The Engineer reserves the right to require additional hot bin gradations for batch

Note 5. The WMA compaction temperature for mixture volumetric testing shall be 270 ± 5 °F (132 ± 3 °C) for quality control testing. The WMA compaction temperature for quality assurance testing will be 270 ± 5 °F (132 ± 3 °C) if the mixture is not allowed to cool to room temperature. If the mixture is allowed to cool to room temperature it shall be reheated to standard HMA compaction temperatures.”

CONSTRUCTION REQUIREMENTS.

Revise the second paragraph of Article 406.06(b)(1) of the Standard Specifications to read:

“The HMA shall be delivered at a temperature of 250 to 350 °F (120 to 175 °C).
WMA shall be delivered at a minimum temperature of 215 °F (102 °C).”

Basis of Payment.

This work will be paid at the contract unit price bid for the HMA pay items involved. Anti-strip will not be paid for separately, but shall be considered as included in the cost of the work.

WEEKLY DBE TRUCKING REPORTS (BDE)

Effective: June 2, 2012

The Contractor shall provide a weekly report of Disadvantaged Business Enterprise (DBE) trucks hired by the Contractor or subcontractors (i.e. not owned by the Contractor or subcontractors) that are used on the jobsite; or used for the delivery and/or removal of equipment/material to and from the jobsite. The jobsite shall also include offsite locations, such as plant sites or storage sites, when those locations are used solely for this contract.

The report shall be submitted on the form provided by the Department within ten business days following the reporting period. The reporting period shall be Monday through Sunday for each week reportable trucking activities occur. The report shall be submitted to the Engineer and a copy shall be provided to the district EEO Officer.

Any costs associated with providing weekly DBE trucking reports shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

STEEL COST ADJUSTMENT (BDE) (RETURN FORM WITH BID)

Effective: April 2, 2004

Revised: April 1, 2009

Description. Steel cost adjustments will be made to provide additional compensation to the Contractor, or a credit to the Department, for fluctuations in steel prices when optioned by the Contractor. The bidder shall indicate on the attached form whether or not this special provision will be part of the contract and submit the completed form with his/her bid. Failure to submit the form or failure to indicate contract number, company name, and sign and date the form shall make this contract exempt of steel cost adjustments for all items of steel. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment.

Types of Steel Products. An adjustment will be made for fluctuations in the cost of steel used in the manufacture of the following items:

- Metal Piling (excluding temporary sheet piling)
- Structural Steel
- Reinforcing Steel

Other steel materials such as dowel bars, tie bars, mesh reinforcement, guardrail, steel traffic signal and light poles, towers and mast arms, metal railings (excluding wire fence), and frames and grates will be subject to a steel cost adjustment when the pay items they are used in has a contract value of \$10,000 or greater.

Documentation. Sufficient documentation shall be furnished to the Engineer to verify the following:

- (a) The dates and quantity of steel, in lb (kg), shipped from the mill to the fabricator.
- (b) The quantity of steel, in lb (kg), incorporated into the various items of work covered by this special provision. The Department reserves the right to verify submitted quantities.

Method of Adjustment. Steel cost adjustments will be computed as follows:

$$SCA = Q \times D$$

Where: SCA = steel cost adjustment, in dollars
Q = quantity of steel incorporated into the work, in lb (kg)
D = price factor, in dollars per lb (kg)

$$D = MPI_M - MPI_L$$

Where: MPI_M = The Materials Cost Index for steel as published by the Engineering News-Record for the month the steel is shipped from the mill. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

MPI_L = The Materials Cost Index for steel as published by the Engineering News-Record for the month prior to the letting. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

The unit weights (masses) of steel that will be used to calculate the steel cost adjustment for the various items are shown in the attached table.

No steel cost adjustment will be made for any products manufactured from steel having a mill shipping date prior to the letting date.

If the Contractor fails to provide the required documentation, the method of adjustment will be calculated as described above; however, the MPI_M will be based on the date the steel arrives at the job site. In this case, an adjustment will only be made when there is a decrease in steel costs.

Basis of Payment. Steel cost adjustments may be positive or negative but will only be made when there is a difference between the MPI_L and MPI_M in excess of five percent, as calculated by:

$$\text{Percent Difference} = \{(MPI_L - MPI_M) \div MPI_L\} \times 100$$

Steel cost adjustments will be calculated by the Engineer and will be paid or deducted when all other contract requirements for the items of work are satisfied. Adjustments will only be made for fluctuations in the cost of the steel as described herein. No adjustment will be made for changes in the cost of manufacturing, fabrication, shipping, storage, etc.

The adjustments shall not apply during contract time subject to liquidated damages for completion of the entire contract.

Attachment

Item	Unit Mass (Weight)
Metal Piling (excluding temporary sheet piling) Furnishing Metal Pile Shells 12 in. (305 mm), 0.179 in. (3.80 mm) wall thickness) Furnishing Metal Pile Shells 12 in. (305 mm), 0.250 in. (6.35 mm) wall thickness) Furnishing Metal Pile Shells 14 in. (356 mm), 0.250 in. (6.35 mm) wall thickness) Other piling	23 lb/ft (34 kg/m) 32 lb/ft (48 kg/m) 37 lb/ft (55 kg/m) See plans
Structural Steel	See plans for weights (masses)
Reinforcing Steel	See plans for weights (masses)
Dowel Bars and Tie Bars	6 lb (3 kg) each
Mesh Reinforcement	63 lb/100 sq ft (310 kg/sq m)
Guardrail Steel Plate Beam Guardrail, Type A w/steel posts Steel Plate Beam Guardrail, Type B w/steel posts Steel Plate Beam Guardrail, Types A and B w/wood posts Steel Plate Beam Guardrail, Type 2 Steel Plate Beam Guardrail, Type 6 Traffic Barrier Terminal, Type 1 Special (Tangent) Traffic Barrier Terminal, Type 1 Special (Flared)	20 lb/ft (30 kg/m) 30 lb/ft (45 kg/m) 8 lb/ft (12 kg/m) 305 lb (140 kg) each 1260 lb (570 kg) each 730 lb (330 kg) each 410 lb (185 kg) each
Steel Traffic Signal and Light Poles, Towers and Mast Arms Traffic Signal Post Light Pole, Tenon Mount and Twin Mount, 30 - 40 ft (9 - 12 m) Light Pole, Tenon Mount and Twin Mount, 45 - 55 ft (13.5 - 16.5 m) Light Pole w/Mast Arm, 30 - 50 ft (9 - 15.2 m) Light Pole w/Mast Arm, 55 - 60 ft (16.5 - 18 m) Light Tower w/Luminaire Mount, 80 - 110 ft (24 - 33.5 m) Light Tower w/Luminaire Mount, 120 - 140 ft (36.5 - 42.5 m) Light Tower w/Luminaire Mount, 150 - 160 ft (45.5 - 48.5 m)	11 lb/ft (16 kg/m) 14 lb/ft (21 kg/m) 21 lb/ft (31 kg/m) 13 lb/ft (19 kg/m) 19 lb/ft (28 kg/m) 31 lb/ft (46 kg/m) 65 lb/ft (97 kg/m) 80 lb/ft (119 kg/m)
Metal Railings (excluding wire fence) Steel Railing, Type SM Steel Railing, Type S-1 Steel Railing, Type T-1 Steel Bridge Rail	64 lb/ft (95 kg/m) 39 lb/ft (58 kg/m) 53 lb/ft (79 kg/m) 52 lb/ft (77 kg/m)
Frames and Grates Frame Lids and Grates	250 lb (115 kg) 150 lb (70 kg)

Return With Bid

**ILLINOIS DEPARTMENT
OF TRANSPORTATION**

**OPTION FOR
STEEL COST ADJUSTMENT**

The bidder shall submit this completed form with his/her bid. Failure to submit the form or properly complete contract number, company name, and sign and date the form shall make this contract exempt of steel cost adjustments for all items of steel. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment. After award, this form, when submitted shall become part of the contract.

Contract No.: _____

Company Name: _____

Contractor's Option:

Is your company opting to include this special provision as part of the contract plans for the following items of work?

- | | | |
|--|-----|--------------------------|
| Metal Piling | Yes | <input type="checkbox"/> |
| Structural Steel | Yes | <input type="checkbox"/> |
| Reinforcing Steel | Yes | <input type="checkbox"/> |
| Dowel Bars, Tie Bars and Mesh Reinforcement | Yes | <input type="checkbox"/> |
| Guardrail | Yes | <input type="checkbox"/> |
| Steel Traffic Signal and Light Poles, Towers and Mast Arms | Yes | <input type="checkbox"/> |
| Metal Railings (excluding wire fence) | Yes | <input type="checkbox"/> |
| Frames and Grates | Yes | <input type="checkbox"/> |

Signature: _____ **Date:** _____

PROJECT LABOR AGREEMENT - QUARTERLY EMPLOYMENT REPORT

Public Act 97-0199 requires the Department to submit quarterly reports regarding the number of minorities and females employed under Project Labor Agreements. To assist in this reporting effort, the Contractor shall provide a quarterly workforce participation report for all minority and female employees working under the project labor agreement of this contract. The data shall be reported on Construction Form BC 820, Project Labor Agreement (PLA) Workforce Participation Quarterly Reporting Form available on the Department's website <http://www.dot.il.gov/const/conforms.html>.

The report shall be submitted no later than the 15th of the month following the end of each quarter (i.e. April 15 for the January – March reporting period). The form shall be emailed to DOT.PLA.Reporting@illinois.gov or faxed to (217) 524-4922.

Any costs associated with complying with this provision shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

Illinois Department of Transportation

PROJECT LABOR AGREEMENT

This Project Labor Agreement (“PLA” or “Agreement”) is entered into this _____ day of _____, 2013, by and between the Illinois Department of Transportation (“IDOT” or “Department”) in its proprietary capacity, and each relevant Illinois AFL-CIO Building Trades signatory hereto as determined by the Illinois AFL-CIO Statewide Project Labor Agreement Committee on behalf of each of its affiliated members (individually and collectively, the “Unions”). This PLA shall apply to Construction Work (as defined herein) to be performed by IDOT’s Prime Contractor and each of its subcontractors of whatever tier (“Subcontractor” or “Subcontractors”) on Contract No. **60W29** (hereinafter, the “Project”).

ARTICLE 1 - INTENT AND PURPOSES

- 1.1 This PLA is entered into in accordance with the Project Labor Agreement Act (“Act”, 30 ILCS 571). It is mutually understood and agreed that the terms and conditions of this PLA are intended to promote the public interest in obtaining timely and economical completion of the Project by encouraging productive and efficient construction operations; by establishing a spirit of harmony and cooperation among the parties; and by providing for peaceful and prompt settlement of any and all labor grievances or jurisdictional disputes of any kind without strikes, lockouts, slowdowns, delays, or other disruptions to the prosecution of the work. The parties acknowledge the obligations of the Contractors and Subcontractors to comply with the provisions of the Act. The parties will work with the Contractors and Subcontractors within the parameters of other statutory and regulatory requirements to implement the Act’s goals and objectives.
- 1.2 As a condition of the award of the contract for performance of work on the Project, IDOT’s Prime Contractor and each of its Subcontractors shall execute a “Contractor Letter of Assent”, in the form attached hereto as Exhibit A, prior to commencing Construction Work on the Project. The Contractor shall submit a Subcontractor’s Contractor Letter of Assent to the Department prior to the Subcontractor’s performance of Construction Work on the Project. Upon request copies of the applicable collective bargaining agreements will be provided by the appropriate signatory labor organization consistent with this Agreement and at the pre-job conference referenced in Article III, Section 3.1.
- 1.3 Each Union affiliate and separate local representing workers engaged in Construction Work on the Project in accordance with this PLA are bound to this agreement by the Illinois AFL-CIO Statewide Project Labor Agreement Committee which is the central committee established with full authority to negotiate and sign PLAs with the State on behalf of all respective crafts. Upon their signing the Contractor Letter of Assent, the Prime Contractor, each Subcontractor, and the individual Unions shall thereafter be deemed a party to this PLA. No party signatory to this PLA shall, contract or subcontract, nor permit any other person, firm, company, or entity to contract or subcontract for the performance of Construction Work for the Project to any person, firm, company, or entity that does not agree in writing to become bound for the term of this Project by the terms of this PLA prior to commencing such work and to the applicable area-wide collective bargaining agreement(s) with the Union(s) signatory hereto.

- 1.4 It is understood that the Prime Contractor(s) and each Subcontractor will be considered and accepted by the Unions as separate employers for the purposes of collective bargaining, and it is further agreed that the employees working under this PLA shall constitute a bargaining unit separate and distinct from all others. The parties hereto also agree that this PLA shall be applicable solely with respect to this Project, and shall have no bearing on the interpretation of any other collective bargaining agreement or as to the recognition of any bargaining unit other than for the specific purposes of this Project.
- 1.5 In the event of a variance or conflict, whether explicit or implicit, between the terms and conditions of this PLA and the provisions of any other applicable national, area, or local collective bargaining agreement, the terms and conditions of this PLA shall supersede and control. For any work performed under the NTL Articles of Agreement, the National Stack/Chimney Agreement, the National Cooling Tower Agreement, the National Agreement of the International Union of Elevator Constructors, and for any instrument calibration work and loop checking performed under the UA/IBEW Joint National Agreement for Instrument and Control Systems Technicians, the preceding sentence shall apply only with respect to Articles I, II, V, VI, and VII.
- 1.6 Subject to the provisions of paragraph 1.5 of this Article, it is the parties' intent to respect the provisions of any other collective bargaining agreements that may now or hereafter pertain, whether between the Prime Contractor and one or more of the Unions or between a Subcontractor and one or more of the Unions. Accordingly, except and to the extent of any contrary provision set forth in this PLA, the Prime Contractor and each of its Subcontractors agrees to be bound and abide by the terms of the following in order of precedence: (a) the applicable collective bargaining agreement between the Prime Contractor and one or more of the Unions made signatory hereto; (b) the applicable collective bargaining agreement between a Subcontractor and one or more of the Unions made signatory hereto; or (c) the current applicable area collective bargaining agreement for the relevant Union that is the agreement certified by the Illinois Department of Labor for purposes of establishing the Prevailing Wage applicable to the Project. The Union will provide copies of the applicable collective bargaining agreements pursuant to part (c) of the preceding sentence to the Prime Contractor. Assignments by the Contractors or Subcontractors amongst the trades shall be consistent with area practices; in the event of unresolved disagreements as to the propriety of such assignments, the provisions of Article VI shall apply.
- 1.7 Subject to the limitations of paragraphs 1.4 to 1.6 of this Article, the terms of each applicable collective bargaining agreement as determined in accordance with paragraph 1.6 are incorporated herein by reference, and the terms of this PLA shall be deemed incorporated into such other applicable collective bargaining agreements only for purposes of their application to the Project.

- 1.8 To the extent necessary to comply with the requirements of any fringe benefit fund to which the Prime Contractor or Subcontractor is required to contribute under the terms of an applicable collective bargaining agreement pursuant to the preceding paragraph, the Prime Contractor or Subcontractor shall execute all "Participation Agreements" as may be reasonably required by the Union to accomplish such purpose; provided, however, that such Participation Agreements shall, when applicable to the Prime Contractor or Subcontractor solely as a result of this PLA, be amended as reasonably necessary to reflect such fact. Upon written notice in the form of a lien of a Contractor's or Subcontractor's delinquency from any applicable fringe benefit fund, IDOT will withhold from the Contractor's periodic pay request an amount sufficient to extinguish any delinquency obligation of the Contractor or Subcontractor arising out of the Project.
- 1.9 In the event that the applicable collective bargaining agreement between a Prime Contractor and the Union or between the Subcontractor and the Union expires prior to the completion of this Project, the expired applicable contract's terms will be maintained until a new applicable collective bargaining agreement is ratified. The wages and fringe benefits included in any new applicable collective bargaining agreement will apply on and after the effective date of the newly negotiated collective bargaining agreement, except to the extent wage and fringe benefit retroactivity is specifically agreed upon by the relevant bargaining parties.

ARTICLE II – APPLICABILITY, RECOGNITION, AND COMMITMENTS

- 2.1 The term Construction Work as used herein shall include all "construction, demolition, rehabilitation, renovation, or repair" work performed by a "laborer or mechanic" at the "site of the work" for the purpose of "building" the specific structures and improvements that constitute the Project. Terms appearing within quotation marks in the preceding sentence shall have the meaning ascribed to them pursuant to 29 CFR Part 5 and Illinois labor laws.
- 2.2 By executing the Letters of Assent, Prime Contractor and each of its Subcontractors recognizes the Unions signatory to this PLA as the sole and exclusive bargaining representatives for their craft employees employed on the jobsite for this Project. Unions who are signatory to this PLA will have recognition on the Project for their craft.
- 2.3 The Prime Contractor and each of its Subcontractors retains and shall be permitted to exercise full and exclusive authority and responsibility for the management of its operations, except as expressly limited by the terms of this PLA or by the terms and conditions of the applicable collective bargaining agreement.
- 2.4 Except to the extent contrary to an express provision of the relevant collective bargaining agreement, equipment or materials used in the Project may be pre-assembled or pre-fabricated, and there shall be no refusal by the Union to handle, transport, install, or connect such equipment or materials. Equipment or materials delivered to the job-site will be unloaded and handled promptly without regard to potential jurisdictional disputes; any such disputes shall be handled in accordance with the provisions of this PLA.

- 2.5 The parties are mutually committed to promoting a safe working environment for all personnel at the job-site. It shall be the responsibility of each employer to which this PLA applies to provide and maintain safe working conditions for its employees, and to comply with all applicable federal, state, and local health and safety laws and regulations.
- 2.6 The use or furnishing of alcohol or drugs and the conduct of any other illegal activity at the job-site is strictly prohibited. The parties shall take every practical measure consistent with the terms of applicable collective bargaining agreements to ensure that the job-site is free of alcohol and drugs.
- 2.7 All parties to this PLA agree that they will not discriminate against any employee based on race, creed, religion, color, national origin, union activity, age, gender or sexual orientation and shall comply with all applicable federal, state, and local laws.
- 2.8 In accordance with the Act and to promote diversity in employment, IDOT will establish, in cooperation with the other parties, the apprenticeship hours which are to be performed by minorities and females on the Project. IDOT shall consider the total hours to be performed by these underrepresented groups, as a percentage of the workforce, and create aspirational goals for each Project, based on the level of underutilization for the service area of the Project (together "Project Employment Objectives"). IDOT shall provide a quarterly report regarding the racial and gender composition of the workforce on the Project.

Persons currently lacking qualifications to enter apprenticeship programs will have the opportunity to obtain skills through basic training programs as have been established by the Department. The parties will endeavor to support such training programs to allow participants to obtain the requisite qualifications for the Project Employment Objectives.

The parties agree that all Contractors and Subcontractors working on the Project shall be encouraged to utilize the maximum number of apprentices as permitted under the terms of the applicable collective bargaining agreements to realize the Project Employment Objectives.

The Unions shall assist the Contractor and each Subcontractor in efforts to satisfy Project Employment Objectives. A Contractor or Subcontractor may request from a Union specific categories of workers necessary to satisfy Project Employment Objectives. The application of this section shall be consistent with all local Union collective bargaining agreements, and the hiring hall rules and regulations established for the hiring of personnel, as well as the apprenticeship standards set forth by each individual Union.

- 2.9 The parties hereto agree that engineering/architectural/surveying consultants' materials testing employees are subject to the terms of this PLA for Construction Work performed for a Contractor or Subcontractor on this Project. These workers shall be fully expected to objectively and responsibly perform their duties and obligations owed to the Department without regard to the potential union affiliation of such employees or of other employees on the Project.
- 2.10 This Agreement shall not apply to IDOT employees or employees of any other governmental entity.

ARTICLE III - ADMINISTRATION OF AGREEMENT

- 3.1 In order to assure that all parties have a clear understanding of the PLA, and to promote harmony, at the request of the Unions a post-award pre-job conference will be held among the Prime Contractor, all Subcontractors and Union representatives prior to the start of any Construction Work on the Project. No later than the conclusion of such pre-job conference, the parties shall, among other matters, provide to one another contact information for their respective representatives (including name, address, phone number, facsimile number, e-mail). Nothing herein shall be construed to limit the right of the Department to discuss or explain the purpose and intent of this PLA with prospective bidders or other interested parties prior to or following its award of the job.
- 3.2 Representatives of the Prime Contractor and the Unions shall meet as often as reasonably necessary following award until completion of the Project to assure the effective implementation of this PLA.
- 3.3 Any notice contemplated under Article VI and VII of this Agreement to a signatory labor organization shall be made in writing to the Local Union with copies to the local union's International Representative.

ARTICLE IV - HOURS OF WORK AND GENERAL CONDITIONS

- 4.1 The standard work day and work week for Construction Work on the Project shall be consistent with the respective collective bargaining agreements. In the event Project site or other job conditions dictate a change in the established starting time and/or a staggered lunch period for portions of the Project or for specific crafts, the Prime Contractor, relevant Subcontractors and business managers of the specific crafts involved shall confer and mutually agree to such changes as appropriate. If proposed work schedule changes cannot be mutually agreed upon between the parties, the hours fixed at the time of the pre-job meeting shall prevail.
- 4.2 Shift work may be established and directed by the Prime Contractor or relevant Subcontractor as reasonably necessary or appropriate to fulfill the terms of its contract with the Department. If used, shift hours, rates and conditions shall be as provided in the applicable collective bargaining agreement.
- 4.3 The parties agree that chronic and/or unexcused absenteeism is undesirable and must be controlled in accordance with procedures established by the applicable collective bargaining agreement. Any employee disciplined for absenteeism in accordance with such procedures shall be suspended from all work on the Project for not less than the maximum period permitted under the applicable collective bargaining agreement.
- 4.4 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, employment begins and ends at the Project site; employees shall be at their place of work at the starting time; and employees shall remain at their place of work until quitting time.
- 4.5 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, there shall be no limit on production by workmen, no restrictions on the full use of tools or equipment, and no restrictions on efficient use of manpower or techniques of construction other than as may be required by safety regulations.

- 4.6 The parties recognize that specialized or unusual equipment may be installed on the Project. In such cases, the Union recognizes the right of the Prime Contractor or Subcontractor to involve the equipment supplier or vendor's personnel in supervising the setting up of the equipment, making modifications and final alignment, and performing similar activities that may be reasonably necessary prior to and during the start-up procedure in order to protect factory warranties. The Prime Contractor or Subcontractor shall notify the Union representatives in advance of any work at the job-site by such vendor personnel in order to promote a harmonious relationship between the equipment vendor's personnel and other Project employees.
- 4.7 For the purpose of promoting full and effective implementation of this PLA, authorized Union representatives shall have access to the Project job-site during scheduled work hours. Such access shall be conditioned upon adherence to all reasonable visitor and security rules of general applicability that may be established for the Project site at the pre-job conference or from time to time thereafter.

ARTICLE V – GRIEVANCE PROCEDURES FOR DISPUTES ARISING UNDER A PARTICULAR COLLECTIVE BARGAINING AGREEMENT

- 5.1 In the event a dispute arises under a particular collective bargaining agreement specifically not including jurisdictional disputes referenced in Article VI below, said dispute shall be resolved by the Grievance/Arbitration procedure of the applicable collective bargaining agreement. The resulting determination from this process shall be final and binding on all parties bound to its process.
- 5.2 Employers covered under this Agreement shall have the right to discharge or discipline any employee who violates the provisions of this Agreement. Such discharge or discipline by a contractor or subcontractor shall be subject to Grievance/Arbitration procedure of the applicable collective bargaining agreement only as to the fact of such violation of this agreement. If such fact is established, the penalty imposed shall not be disturbed. Work at the Project site shall continue without disruption or hindrance of any kind as a result of a Grievance/Arbitration procedure under this Article.
- 5.3 In the event there is a deadlock in the foregoing procedure, the parties agree that the matter shall be submitted to arbitration for the selection and decision of an Arbitrator governed under paragraph 6.8.

ARTICLE VI –DISPUTES: GENERAL PRINCIPLES

- 6.1 This Agreement is entered into to prevent strikes, lost time, lockouts and to facilitate the peaceful adjustment of jurisdictional disputes in the building and construction industry and to prevent waste and unnecessary avoidable delays and expense, and for the further purpose of at all times securing for the employer sufficient skilled workers.
- 6.2 A panel of Permanent Arbitrators are attached as addendum (A) to this agreement. By mutual agreement between IDOT and the Unions, the parties can open this section of the agreement as needed to make changes to the list of permanent arbitrators.
- 6.3 The PLA Jurisdictional Dispute Resolution Process ("Process") sets forth the procedures below to resolve jurisdictional disputes between and among Contractors, Subcontractors, and Unions engaged in the building and construction industry. Further,

the Process will be followed for any grievance or dispute arising out of the interpretation or application of this PLA by the parties except for the prohibition on attorneys contained in 6.11. All decisions made through the Process are final and binding upon all parties.

DISPUTE PROCESS

- 6.4 Administrative functions under the Process shall be performed through the offices of the President and/or Secretary-Treasurer of the Illinois State Federation of Labor, or their designated representative, called the Administrator. In no event shall any officer, employee, agent, attorney, or other representative of the Illinois Federation of Labor, AFL-CIO be subject to any subpoena to appear or testify at any jurisdictional dispute hearing.
- 6.5 There shall be no abandonment of work during any case participating in this Process or in violation of the arbitration decision. All parties to this Process release the Illinois State Federation of Labor ("Federation") from any liability arising from its action or inaction and covenant not to sue the Federation, nor its officers, employees, agents or attorneys.
- 6.6 In the event of a dispute relating to trade or work jurisdiction, all parties, including the employers, Contractors or Subcontractors, agree that a final and binding resolution of the dispute shall be resolved as follows:
- (a) Representatives of the affected trades and the Contractor or Subcontractor shall meet on the job site within two (2) business days after receiving written notice in an effort to resolve the dispute. (In the event there is a dispute between local unions affiliated with the same International Union, the decision of the General President, or his/her designee, as the internal jurisdictional authority of that International Union, shall constitute a final and binding decision and determination as to the jurisdiction of work.)
 - (b) If no settlement is achieved subsequent to the preceding Paragraph, the matter shall be referred to the local area Building & Construction Trades Council, which shall meet with the affected trades within two (2) business days subsequent to receiving written notice. In the event the parties do not wish to avail themselves of the local Building & Construction Trades Council, the parties may elect to invoke the services of their respective International Representatives with no extension of the time limitations. An agreement reached at this Step shall be final and binding upon all parties.

(c) If no settlement agreement is reached during the proceedings contemplated by Paragraphs "a" or "b" above, the matter shall be immediately referred to the Illinois Jurisdictional Dispute Process for final and binding resolution of said dispute. Said referral submission shall be in writing and served upon the Illinois State Federation of Labor, or the Administrator, pursuant to paragraph 6.4 of this agreement. The Administrator shall, within three (3) days, provide for the selection of an available Arbitrator to hear said dispute within this time period. Upon good cause shown and determined by the Administrator, an additional three (3) day extension for said hearing shall be granted at the sole discretion of the Administrator. Only upon mutual agreement of all parties may the Administrator extend the hearing for a period in excess of the time frames contemplated under this Paragraph. Business days are defined as Monday through Friday, excluding contract holidays.

6.7 The primary concern of the Process shall be the adjustment of jurisdictional disputes arising out of the Project. A sufficient number of Arbitrators shall be selected from list of approved Arbitrators as referenced Sec. 6.2 and shall be assigned per Sec. 6.8. Decisions shall be only for the Project and shall become effective immediately upon issuance and complied with by all parties. The authority of the Arbitrator shall be restricted and limited specifically to the terms and provisions of Article VI and generally to this Agreement as a whole.

6.8 The Arbitrator chosen shall be randomly selected based on the list of Arbitrators in Sec. 6.2 and geographical location of the jurisdictional dispute and upon his/her availability, and ability to conduct a Hearing within two (2) business days of said notice. The Arbitrator may issue a "bench" decision immediately following the Hearing or he/she may elect to only issue a written decision, said decision must be issued within two (2) business days subsequent to the completion of the Hearing. Copies of all notices, pleadings, supporting memoranda, decisions, etc. shall be provided to all disputing parties and the Illinois State Federation of Labor.

Any written decision shall be in accordance with this Process and shall be final and binding upon all parties to the dispute and may be a "short form" decision. Fees and costs of the arbitrator shall be divided evenly between the contesting parties except that any party wishing a full opinion and decision beyond the short form decision shall bear the reasonable fees and costs of such full opinion. The decision of the Arbitrator shall be final and binding upon the parties hereto, their members, and affiliates.

In cases of jurisdictional disputes or other disputes between a signatory labor organization and another labor organization, both of which is an affiliate or member of the same International Union, the matter or dispute shall be settled in the manner set forth by their International Constitution and/or as determined by the International Union's General President whose decision shall be final and binding upon all parties. In no event shall there be an abandonment of work.

6.9 In rendering a decision, the Arbitrator shall determine:

(a) First, whether a previous agreement of record or applicable agreement, including a disclaimer agreement, between National or International Unions to the dispute or agreements between local unions involved in the dispute, governs;

(b) Only if the Arbitrator finds that the dispute is not covered by an appropriate or

applicable agreement of record or agreement between the crafts to the dispute, he shall then consider the established trade practice in the industry and prevailing practice in the locality. Where there is a previous decision of record governing the case, the Arbitrator shall give equal weight to such decision of record, unless the prevailing practice in the locality in the past ten years favors one craft. In that case, the Arbitrator shall base his decision on the prevailing practice in the locality. Except, that if the Arbitrator finds that a craft has improperly obtained the prevailing practice in the locality through raiding, the undercutting of wages or by the use of vertical agreements, the Arbitrator shall rely on the decision of record and established trade practice in the industry rather than the prevailing practice in the locality; and,

- (c) Only if none of the above criteria is found to exist, the Arbitrator shall then consider that because efficiency, cost or continuity and good management are essential to the well being of the industry, the interests of the consumer or the past practices of the employer shall not be ignored.
- 6.10 The Arbitrator shall set forth the basis for his/her decision and shall explain his/her findings regarding the applicability of the above criteria. If lower ranked criteria are relied upon, the Arbitrator shall explain why the higher-ranked criteria were not deemed applicable. The Arbitrator's decision shall only apply to the Project. Agreements of Record, for other PLA projects, are applicable only to those parties signatory to such agreements. Decisions of Record are those that were either attested to by the former Impartial Jurisdictional Disputes Board or adopted by the National Arbitration Panel.
- 6.11 All interested parties, as determined by the Arbitrator, shall be entitled to make presentations to the Arbitrator. Any interested labor organization affiliated to the PLA Committee and party present at the Hearing, whether making a presentation or not, by such presence shall be deemed to accept the jurisdiction of the Arbitrator and to agree to be bound by its decision. In addition to the representative of the local labor organization, a representative of the labor organization's International Union may appear on behalf of the parties. Each party is responsible for arranging for its witnesses. In the event an Arbitrator's subpoena is required, the party requiring said subpoena shall prepare the subpoena for the Arbitrator to execute. Service of the subpoena upon any witness shall be the responsibility of the issuing party.

Attorneys shall not be permitted to attend or participate in any portion of a Hearing.

The parties are encouraged to determine, prior to Hearing, documentary evidence which may be presented to the Arbitrator on a joint basis.

- 6.12 The Order of Presentation in all Hearings before an Arbitrator shall be
- I. Identification and Stipulation of the Parties
 - II. Unions(s) claiming the disputed work presents its case
 - III. Union(s) assigned the disputed work presents its case
 - IV. Employer assigning the disputed work presents its case
 - V. Evidence from other interested parties (i.e., general contractor, project manager, owner)
 - VI. Rebuttal by union(s) claiming the disputed work
 - VII. Additional submissions permitted and requested by Arbitrator
 - VIII. Closing arguments by the parties
- 6.13 All parties bound to the provisions of this Process hereby release the Illinois State Federation of Labor and IDOT, their respective officers, agents, employees or designated representatives, specifically including any Arbitrator participating in said Process, from any and all liability or claim, of whatsoever nature, and specifically incorporating the protections provided in the Illinois Arbitration Act, as amended from time to time.
- 6.14 The Process, as an arbitration panel, nor its Administrator, shall have any authority to undertake any action to enforce its decision(s). Rather, it shall be the responsibility of the prevailing party to seek appropriate enforcement of a decision, including findings, orders or awards of the Arbitrator or Administrator determining non-compliance with a prior award or decision.
- 6.15 If at any time there is a question as to the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process, the primary responsibility for any determination of the arbitrability of a dispute and the jurisdiction of the Arbitrator shall be borne by the party requesting the Arbitrator to hear the underlying jurisdictional dispute. The affected party or parties may proceed before the Arbitrator even in the absence or one or more stipulated parties with the issue of jurisdiction as an additional item to be decided by the Arbitrator. The Administrator may participate in proceedings seeking a declaration or determination that the underlying dispute is subject to the jurisdiction and process of the Illinois Jurisdictional Dispute Resolution Process. In any such proceedings, the non-prevailing party and/or the party challenging the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process shall bear all the costs, expenses and attorneys' fees incurred by the Illinois Jurisdictional Dispute Resolution Process and/or its Administrator in establishing its jurisdiction.

ARTICLE VII - WORK STOPPAGES AND LOCKOUTS

- 7.1 During the term of this PLA, no Union or any of its members, officers, stewards, employees, agents or representatives shall instigate, support, sanction, maintain, or participate in any strike, picketing, walkout, work stoppage, slow down or other activity that interferes with the routine and timely prosecution of work at the Project site or at any other contractor's or supplier's facility that is necessary to performance of work at the Project site. Hand billing at the Project site during the designated lunch period and before commencement or following conclusion of the established standard workday shall not, in itself, be deemed an activity that interferes with the routine and timely prosecution of work on the Project.

- 7.2 Should any activity prohibited by paragraph 7.1 of this Article occur, the Union shall undertake all steps reasonably necessary to promptly end such prohibited activities.
- 7.2.A No Union complying with its obligations under this Article shall be liable for acts of employees for which it has no responsibility or for the unauthorized acts of employees it represents. Any employee who participates or encourages any activity prohibited by paragraph 7.1 shall be immediately suspended from all work on the Project for a period equal to the greater of (a) 60 days; or (b) the maximum disciplinary period allowed under the applicable collective bargaining agreement for engaging in comparable unauthorized or prohibited activity.
- 7.2.B Neither the PLA Committee nor its affiliates shall be liable for acts of employees for which it has no responsibility. The principal officer or officers of the PLA Committee will immediately instruct, order and use the best efforts of his office to cause the affiliated union or unions to cease any violations of this Article. The PLA Committee in its compliance with this obligation shall not be liable for acts of its affiliates. The principal officer or officers of any involved affiliate will immediately instruct, order or use the best effort of his office to cause the employees the union represents to cease any violations of this Article. A union complying with this obligation shall not be liable for unauthorized acts of employees it represents. The failure of the Contractor to exercise its rights in any instance shall not be deemed a waiver of its rights in any other instance.
- During the term of this PLA, the Prime Contractor and its Subcontractors shall not engage in any lockout at the Project site of employees covered by this Agreement.
- 7.3 Upon notification of violations of this Article, the principal officer or officers of the local area Building and Construction Trades Council, and the Illinois AFL-CIO Statewide Project Labor Agreement Committee as appropriate, will immediately instruct, order and use their best efforts to cause the affiliated union or unions to cease any violations of this Article. A Trades Council and the Committee otherwise in compliance with the obligations under this paragraph shall not be liable for unauthorized acts of its affiliates.
- 7.4 In the event that activities in violation of this Article are not immediately halted through the efforts of the parties, any aggrieved party may invoke the special arbitration provisions set forth in paragraph 7.5 of this Article.
- 7.5 Upon written notice to the other involved parties by the most expeditious means available, any aggrieved party may institute the following special arbitration procedure when a breach of this Article is alleged:
- 7.5.A The party invoking this procedure shall notify the individual designated as the Permanent Arbitrator pursuant to paragraph 6.8 of the nature of the alleged violation; such notice shall be by the most expeditious means possible. The initiating party may also furnish such additional factual information as may be reasonably necessary for the Permanent Arbitrator to understand the relevant circumstances. Copies of any written materials provided to the arbitrator shall also be contemporaneously provided by the most expeditious means possible to the party alleged to be in violation and to all other involved parties.
- 7.5.B Upon receipt of said notice the Permanent Arbitrator shall set and hold a hearing within twenty-four (24) hours if it is contended the violation is ongoing, but not

before twenty-four (24) hours after the written notice to all parties involved as required above.

- 7.5.C The Permanent Arbitrator shall notify the parties by facsimile or any other effective written means, of the place and time chosen by the Permanent Arbitrator for this hearing. Said hearing shall be completed in one session. A failure of any party or parties to attend said hearing shall not delay the hearing of evidence or issuance of an Award by the Permanent Arbitrator.
- 7.5.D The sole issue at the hearing shall be whether a violation of this Article has, in fact, occurred. An Award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without a written opinion. If any party desires a written opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the Award. The Permanent Arbitrator may order cessation of the violation of this Article, and such Award shall be served on all parties by hand or registered mail upon issuance.
- 7.5.E Such Award may be enforced by any court of competent jurisdiction upon the filing of the Award and such other relevant documents as may be required. Facsimile or other hardcopy written notice of the filing of such enforcement proceedings shall be given to the other relevant parties. In a proceeding to obtain a temporary order enforcing the Permanent Arbitrator's Award as issued under this Article, all parties waive the right to a hearing and agree that such proceedings may be *ex parte*. Such agreement does not waive any party's right to participate in a hearing for a final order of enforcement. The Court's order or orders enforcing the Permanent Arbitrator's Award shall be served on all parties by hand or by delivery to their last known address or by registered mail.
- 7.6 Individuals found to have violated the provisions of this Article are subject to immediate termination. In addition, IDOT reserves the right to terminate this PLA as to any party found to have violated the provisions of this Article.
- 7.7 Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance therewith are hereby waived by parties to whom they accrue.
- 7.8 The fees and expenses of the Permanent Arbitrator shall be borne by the party or parties found in violation, or in the event no violation is found, such fees and expenses shall be borne by the moving party.

ARTICLE VIII – TERMS OF AGREEMENT

- 8.1 If any Article or provision of this Agreement shall be declared invalid, inoperative or unenforceable by operation of law or by any of the above mentioned tribunals of competent jurisdiction, the remainder of this Agreement or the application of such Article or provision to persons or circumstances other than those as to which it has been held invalid, inoperative or unenforceable shall not be affected thereby.
- 8.2 This Agreement shall be in full force as of and from the date of the Notice of Award until the Project contract is closed.

- 8.3 This PLA may not be changed or modified except by the subsequent written agreement of the parties. All parties represent that they have the full legal authority to enter into this PLA. This PLA may be executed by the parties in one or more counterparts.
- 8.4 Any liability arising out of this PLA shall be several and not joint. IDOT shall not be liable to any person or other party for any violation of this PLA by any other party, and no Contractor or Union shall be liable for any violation of this PLA by any other Contractor or Union.
- 8.5 The failure or refusal of a party to exercise its rights hereunder in one or more instances shall not be deemed a waiver of any such rights in respect of a separate instance of the same or similar nature.

[The Balance of This Page Intentionally Left Blank]

Addendum A

IDOT Slate of Permanent Arbitrators

1. Bruce Feldacker
2. Thomas F. Gibbons
3. Edward J. Harrick
4. Brent L. Motchan
5. Robert Perkovich
6. Byron Yaffee
7. Glenn A. Zipp

Execution Page

Illinois Department of Transportation

Omer Osman, Director of Highways

Matthew Hughes, Director Finance & Administration

Michael A. Forti, Chief Counsel

Ann L. Schneider, Secretary

(Date)

Illinois AFL-CIO Statewide Project Labor Agreement Committee, representing the Unions listed below:

(Date)

List Unions:

****RETURN WITH BID****

Exhibit A - Contractor Letter of Assent

(Date)

To All Parties:

In accordance with the terms and conditions of the contract for Construction Work on [Contract No. **60W29**], this Letter of Assent hereby confirms that the undersigned Prime Contractor or Subcontractor agrees to be bound by the terms and conditions of the Project Labor Agreement established and entered into by the Illinois Department of Transportation in connection with said Project.

It is the understanding and intent of the undersigned party that this Project Labor Agreement shall pertain only to the identified Project. In the event it is necessary for the undersigned party to become signatory to a collective bargaining agreement to which it is not otherwise a party in order that it may lawfully make certain required contributions to applicable fringe benefit funds, the undersigned party hereby expressly conditions its acceptance of and limits its participation in such collective bargaining agreement to its work on the Project.

(Authorized Company Officer)

(Company)

****RETURN WITH BID****

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If

the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color,

religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. Davis-Bacon and Related Act Provisions

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such

action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for

debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such

contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.

2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded,"

as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with

commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the

certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

**MINIMUM WAGES FOR FEDERAL AND FEDERALLY
ASSISTED CONSTRUCTION CONTRACTS**

This project is funded, in part, with Federal-aid funds and, as such, is subject to the provisions of the Davis-Bacon Act of March 3, 1931, as amended (46 Sta. 1494, as amended, 40 U.S.C. 276a) and of other Federal statutes referred to in a 29 CFR Part 1, Appendix A, as well as such additional statutes as may from time to time be enacted containing provisions for the payment of wages determined to be prevailing by the Secretary of Labor in accordance with the Davis-Bacon Act and pursuant to the provisions of 29 CFR Part 1. The prevailing rates and fringe benefits shown in the General Wage Determination Decisions issued by the U.S. Department of Labor shall, in accordance with the provisions of the foregoing statutes, constitute the minimum wages payable on Federal and federally assisted construction projects to laborers and mechanics of the specified classes engaged on contract work of the character and in the localities described therein.

General Wage Determination Decisions, modifications and supersedes decisions thereto are to be used in accordance with the provisions of 29 CFR Parts 1 and 5. Accordingly, the applicable decision, together with any modifications issued, must be made a part of every contract for performance of the described work within the geographic area indicated as required by an applicable DBRA Federal prevailing wage law and 29 CFR Part 5. The wage rates and fringe benefits contained in the General Wage Determination Decision shall be the minimum paid by contractors and subcontractors to laborers and mechanics.

NOTICE

The most current **General Wage Determination Decisions** (wage rates) are available on the IDOT web site. They are located on the Letting and Bidding page at <http://www.dot.state.il.us/desenv/delett.html>.

In addition, ten (10) days prior to the letting, the applicable Federal wage rates will be e-mailed to subscribers. It is recommended that all contractors subscribe to the Federal Wage Rates List or the Contractor's Packet through IDOT's subscription service.

PLEASE NOTE: if you have already subscribed to the Contractor's Packet you will automatically receive the Federal Wage Rates.

The instructions for subscribing are at <http://www.dot.state.il.us/desenv/subsc.html>.

If you have any questions concerning the wage rates, please contact IDOT's Chief Contract Official at 217-782-7806.