

If you plan to submit a bid directly to the Department of Transportation

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.

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 124INT) 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.

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.

WHAT CONSTITUTES WRITTEN AUTHORIZATION TO BID?: When a prospective prime bidder submits a "Request for Authorization to Bid/or Not For Bid Status"(BDE 124INT) 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 a **Proposal Denial and/or Authorization Form**, approved by the Central Bureau of Construction, that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Proposal Denial and/or Authorization Form** will indicate the reason for denial.

ABOUT AUTHORIZATION TO BID: Firms that have not received an authorization form within a reasonable time of complete and correct original document submittal should contact the department as to status. This is critical in the week before the letting. These documents must be received three days before the letting date. 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 contractor'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 will be placed with the contract number. 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 server e-mails 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 D&Econtracts@dot.il.gov

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

WHAT MUST BE INCLUDED WHEN BIDS ARE SUBMITTED?: Bidders need not return the entire proposal when bids are submitted. That portion of the proposal that must be returned includes the following:

1. All documents from the Proposal Cover Sheet through the Proposal Bid Bond
2. Other special documentation and/or information that may be required by the contract special provisions

All proposal documents, including Proposal Guaranty Checks or Proposal Bid Bonds, should be stapled together to prevent loss when bids are processed by IDOT personnel.

ABOUT SUBMITTING BIDS: It is recommended that bidders deliver bids in person to insure they arrive at the proper location prior to the time specified for the receipt of bids. Any bid received at the place of letting after the time specified will not be accepted.

WHO SHOULD BE CALLED IF ASSISTANCE IS NEEDED?

Questions Regarding	Call
Prequalification and/or Authorization to Bid	217/782-3413
Preparation and submittal of bids	217/782-7806
Mailing of plans and proposals	217/782-7806

ADDENDUMS AND REVISIONS TO THE PROPOSAL FORMS

Planholders should verify that they have received and incorporated any addendum and/or revision prior to submitting their bid. Failure by the bidder to include an addendum or revision could result in a bid being rejected as irregular.

RETURN WITH BID

1

Proposal Submitted By
Name
Address
City

Special Letting August 14, 2009

BIDDERS NEED NOT RETURN THE ENTIRE PROPOSAL
(See instructions inside front cover)

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.

(SEE INSTRUCTIONS ON THE INSIDE OF COVER)

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



**Illinois Department
of Transportation**

Springfield, Illinois 62764

**Contract No. 60D61
COOK County
Section 2424.2B-R
Route FAP 389
Project BHF-389(004)
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

Prepared by

Checked by

F

(Printed by authority of the State of Illinois)

INSTRUCTIONS

ABOUT IDOT PROPOSALS: All proposals issued by IDOT are potential bidding proposals. Each proposal contains all Certifications and Affidavits, a Proposal Signature Sheet and a Proposal Bid Bond required for Prime Contractors to submit a bid after written **Authorization to Bid** has been issued by IDOT's Central Bureau of Construction.

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. To request authorization, a potential bidder must complete and submit Part B of the Request for Authorization to Bid/or Not For Bid Status form (BDE 124 INT) and submit an original Affidavit of Availability (BC 57).

WHAT CONSTITUTES WRITTEN AUTHORIZATION TO BID?: When a prospective prime bidder submits a "Request for Proposal Forms and Plans" 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 a **Proposal Denial and/or Authorization Form**, approved by the Central Bureau of Construction, that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Proposal Denial and/or Authorization Form** will indicate the reason for denial. If a contractor has requested to bid but has not received a **Proposal Denial and/or Authorization Form**, they should contact the Central Bureau of Construction in advance of the letting date.

WHAT MUST BE INCLUDED WHEN BIDS ARE SUBMITTED?: Bidders need not return the entire proposal when bids are submitted. That portion of the proposal that must be returned includes the following:

1. All documents from the Proposal Cover Sheet through the Proposal Bid Bond
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Mailing of CD-ROMS	217/782-7806

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. 60D61
COOK County
Section 2424.2B-R
Project BHF-389(004)
Route FAP 389
District 1 Construction Funds**

Rehabilitation of the existing bridge carrying Congress Parkway over the south branch of the Chicago River (SN 016-2445) and bridge painting with other repairs to the structure carrying Congress Parkway between Chicago River and Post Office (SN 016-0460) all located in the city of 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 shall govern performance and payments.

RETURN WITH BID

6. **COMBINATION BIDS.** The undersigned 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 proposal 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 shall 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. **CERTIFICATE OF AUTHORITY.** The undersigned bidder, if a business organized under the laws of another State, assures the Department that it will furnish a copy of its certificate of authority to do business in the State of Illinois with the return of the executed contract and bond. Failure to furnish the certificate within the time provided for execution of an awarded contract may be cause for cancellation of the award and forfeiture of the proposal guaranty to the State.

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER - 60D61

State Job # - C-91-073-08
 PPS NBR - 1-75659-0100
 County Name - COOK- -
 Code - 31 - -
 District - 1 - -
 Section Number - 2424.2B-R

Project Number
 BHF-0389/004/

Route
 FAP 389

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
XX003988	TEMP CONC BARRIER REM	FOOT	3,136.000				
XX005656	INLET FILTER CLEANING	EACH	22.000				
XX006677	TREE WELL	EACH	6.000				
XX007763	TEMP FENCE SPL	FOOT	300.000				
X0322185	BR DK LTX C OLY 2 1/4	SQ YD	1,040.000				
X0322256	TEMP INFO SIGNING	SQ FT	1,805.000				
X0325305	STR REP CON DP = < 5	SQ FT	57.000				
X0325702	NIGHT WORK ZONE LIGHT	L SUM	1.000				
X0325775	WET RF TEM TAPE T3 4	FOOT	25,720.000				
X0325840	WET RF TEM TAPE T3 12	FOOT	190.000				
X0325841	WET RF TEM TAPE T3 24	FOOT	76.000				
X0325842	WET RF TEM TAPE T3 LS	SQ FT	55.000				
X0325876	WET RF TEM TAPE T3 8	FOOT	7,110.000				
X0326107	WET RF TEM TAPE T3 5	FOOT	2,460.000				
X0326496	TOGGLE SWITCH 20 AMP	EACH	14.000				

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X0326497	600W 120V DIMMER	EACH	2.000				
X0326498	GFCI20A DX RECEPTACLE	EACH	47.000				
X0326499	BR TMPWR/CTRL DRCONST	L SUM	1.000				
X0326500	BR OPS/MNT DR CONSTRN	L SUM	1.000				
X0326501	ACCEPTANCE TESTING	L SUM	1.000				
X0326502	FIBER OPTIC SPLICE	L SUM	1.000				
X0326503	CCTV SYSTEM	L SUM	1.000				
X0326504	FIB OPT CABLE SL MODE	L SUM	1.000				
X0326505	CON CAB CND RACWY SYS	L SUM	1.000				
X0326506	ECAC SB 16C8 10GA	FOOT	475.000				
X0326507	ECAC SB 6C250KCMIL2GB	FOOT	475.000				
X0326508	ECAC SB 6C8 16C6 10GC	FOOT	475.000				
X0326509	ECAC SB 3C1/03C4/04GD	FOOT	475.000				
X0326510	ECAC SB 3C4/0 4GE	FOOT	475.000				
X0326511	ECAC SB 6C250KCMIL2GF	FOOT	475.000				

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X0326512	ECAC SB 22C8 10GG	FOOT	475.000				
X0326513	ECAC SB 18C63/C4/04GH	FOOT	475.000				
X0326514	ECASB54C1313C813C4C99	FOOT	475.000				
X0326515	ECAC SB C100	FOOT	475.000				
X0326516	ECAC SB C294	FOOT	475.000				
X0326517	ECAC SB C294 II	FOOT	475.000				
X0326518	ECAC SB FO 96 3#10	FOOT	475.000				
X0326519	STEEL RAILING REMOVAL	FOOT	84.000				
X0326520	T THRIE SPGR D REM SP	FOOT	454.000				
X0326521	CHN LK CANT SLD GT SP	EACH	1.000				
X0326522	PREC MOD RET WALL	FOOT	245.000				
X0326523	ASBESTOS REMOVAL	L SUM	1.000				
X0326524	REMOV EX ALUM RAILING	FOOT	621.000				
X0326525	TEMP RAIS REF PM B SP	EACH	50.000				
X0326526	F-SHAPE ALUM PARAPET	FOOT	533.000				

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X0326527	TEMP THRIE SPGR D SP	FOOT	454.000				
X0326528	AB RES POLY BR WR SUR	SQ FT	20,220.000				
X0326529	CARB FIB REIN POLY RP	SQ FT	996.000				
X0326530	ABR RES POLY SDWK SUR	SQ FT	3,682.000				
X0326531	COUNTRWGHT PIT CLEANG	EACH	4.000				
X0326532	F&E STL ORTHO BR DECK	SQ FT	20,220.000				
X0326533	F&E STL ORTHO SIDEWLK	SQ FT	3,682.000				
X0326534	REM REINST ALUM PARPT	FOOT	741.000				
X0326535	SDWK FLR OVR R ARM 2	SQ FT	160.000				
X0326536	BR DK AT R ARM 4 1/4	SQ FT	60.000				
X0326537	TIMBER BUMPERS	FOOT	32.000				
X0326538	METAL HAND GUARD RAIL	FOOT	1,235.000				
X0326539	STAIRWELL REHAB	L SUM	1.000				
X0326540	METAL LADDERS	EACH	9.000				
X0326541	METAL SHIP LADDERS	EACH	9.000				

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X0326542	METAL GRATING	L SUM	1.000				
X0326543	CONCRETE STAIR REPAIR	L SUM	1.000				
X0326544	WINDOW BLINDS	L SUM	1.000				
X0326545	METAL STAIRS	L SUM	1.000				
X0326546	TRAFFIC GATES	EACH	8.000				
X0326547	WINDOWS	L SUM	1.000				
X0326548	MEMBRANE ROOFING	EACH	2.000				
X0326549	STONE MSONRY RPR REPL	L SUM	1.000				
X0326550	METAL PANELS	L SUM	1.000				
X0326551	TCBATS316N4X48X36X20H	EACH	4.000				
X0326552	BASC SPAN LIGHTS R/G	EACH	4.000				
X0326553	PIER LIGHTS	EACH	8.000				
X0326554	MOTOR SPEED SWITCHES	EACH	8.000				
X0326555	MAIN SPAN DRV MOTORS	EACH	8.000				
X0326556	MECHANICAL DEMOLITION	L SUM	1.000				

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X0326557	REFURB OPER MACHINERY	L SUM	1.000				
X0326558	REPL CENTER LOCKS	EACH	4.000				
X0326559	NON-DSTRCTVE TEST NDT	L SUM	1.000				
X0326560	REPL TRN THRT CLLR AS	EACH	16.000				
X0326561	REPL TRN BRG BT ABLTS	L SUM	1.000				
X0326562	REFURB LIVE LOAD BRGS	EACH	8.000				
X0326563	SPAN BALANCE	L SUM	1.000				
X0326564	VECTOR CONT MOTOR DR	EACH	8.000				
X0326565	REPL BARRIER GATES	EACH	2.000				
X0326566	REPLACE SUMP PUMPS	EACH	4.000				
X0326567	PBX ATS316S4XH16X12X6	EACH	8.000				
X0326568	1600A MCB65KA IC SWBD	EACH	1.000				
X0326569	EMGEN800K.8PF3P4W480V	EACH	1.000				
X0326570	WTHRPRF GEN ENCLOSURE	EACH	1.000				
X0326571	SWITCH AUTO XFR1600/3	EACH	1.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0326572	PANEL 42CCT3P208/120	EACH	2.000				
X0326573	PANEL 30CCT3P208/120	EACH	2.000				
X0326574	DRIVE VAR FREQ 3H 480	EACH	4.000				
X0326575	ENCLSR NEMA 4SS DE 3H	EACH	2.000				
X0326576	MC CTR 800A480Y227V3P	EACH	2.000				
X0326577	ECC 600EPRTC3C10&12G	FOOT	2,008.000				
X0326578	ECC 600EPRTC4C6&8G	FOOT	40.000				
X0326579	ECC 600EPRTC 3C4 & 8G	FOOT	45.000				
X0326580	ECC 600EPRTC 3C1/0&6G	FOOT	374.000				
X0326581	ECC 600EPRTC 4C1/0&4G	FOOT	45.000				
X0326582	ECC 600EPRTC 3C2/0&4G	FOOT	824.000				
X0326583	ECC 600EPRTC 4C4/0&2G	FOOT	150.000				
X0326584	ECC 600EPRTC 3C250&2G	FOOT	883.000				
X0326585	ECC 600EPRTC 3C350&2G	FOOT	971.000				
X0326586	PBXATS316S4X60X60X16F	EACH	1.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0326587	PBXATS316S4X 36X48X16	EACH	3.000				
X0326588	PBXATS316S4X48X36X20	EACH	3.000				
X0326589	PBXATS316S4X 36X36X36	EACH	1.000				
X0326590	PBXATS316S4X 24X24X16	EACH	2.000				
X0326591	ECC600EPRTC4C350&1/0G	FOOT	1,620.000				
X0326592	CONDUIT FLX LTSS3/4 6	EACH	4.000				
X0326593	CONDUIT FLX LT SS 1 6	EACH	32.000				
X0326594	CONDUIT FLXLTSS 1.5 6	EACH	2.000				
X0326595	CONDUIT FLXLTSS 2.5 6	EACH	6.000				
X0326596	CONDUIT FLX LT SS 3 6	EACH	4.000				
X0326597	ELECTRICAL DEMOLITION	L SUM	1.000				
X0326598	ELEC DEMO N INC HZ MT	L SUM	1.000				
X0326599	TRNSFMR 480/120 45KVA	EACH	2.000				
X0326600	TRNSFMR 480/120 15KVA	EACH	3.000				
X0326601	DISCON SW 3P 600V 30A	EACH	28.000				

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X0326602	DISCON SW 3P 600V100A	EACH	2.000				
X0326603	DISCON SW 3P 600V200A	EACH	6.000				
X0326604	DISCON SW 3P 600V400A	EACH	2.000				
X0326605	GS SLV 1.5 INC C P F	EACH	12.000				
X0326606	GS SLV 2 INC C P F	EACH	6.000				
X0326607	GS SLV 3 INC C P F	EACH	12.000				
X0326608	GS SLV 3.5 INC C P F	EACH	8.000				
X0326609	GROUNDING	L SUM	1.000				
X0326610	ELEC TERMINATION 600V	EACH	456.000				
X0326611	ELEC COND & CBL TAGS	EACH	208.000				
X0326612	MOGUL FITTING 1" DIA	EACH	12.000				
X0326613	MOGUL FTG 2.5" DIA	EACH	1.000				
X0326614	TCBATS316N4X24X24X16H	EACH	2.000				
X0326615	INT BR CNT SYS	L SUM	1.000				
X0326618	ADDRES FIRE ALARM SYS	L SUM	1.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0326619	#12 AWG XHHW-2 WIRE	FOOT	8,500.000				
X0326620	#10 AWG XHHW-2 WIRE	FOOT	1,500.000				
X0326621	TA INT HID M HAL LUMN	EACH	40.000				
X0326622	TB INT IND FL LUMINAR	EACH	27.000				
X0326623	TB-1 INIDFL LUM LT BL	EACH	26.000				
X0326624	TC REC FLUO LUMINAIRE	EACH	10.000				
X0326625	TD P S MT FLUORESCENT	EACH	12.000				
X0326626	TE LED EXT SIGN BP WM	EACH	18.000				
X0326627	TE1 LED EXT SGN BP CM	EACH	2.000				
X0326628	TF STAIR FL LUMINAIRE	EACH	8.000				
X0326629	TG EMCY LT BTY UNT WM	EACH	50.000				
X0326630	TG1 EMCY LT BTY UNTCM	EACH	2.000				
X0326631	TH OD ST H MHW LUM PC	EACH	2.000				
X0326632	WTHRPRF TGL SWTCH 20A	EACH	24.000				
X0326633	NEMA SS ENC V C M DRS	EACH	8.000				

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X0326634	PVC COAT 3/4 GS CONDT	FOOT	5,000.000				
X0326635	P LT P AL TB 3 DA TWN	EACH	3.000				
X0326636	LUM HP SV HM 200 REFR	EACH	18.000				
X0326637	BR LPAL TB47.5 3DA TW	EACH	6.000				
X0326638	MOUNT BRACK TS EX STR	EACH	2.000				
X0326639	MOUNT BRCK TLP EX STR	EACH	9.000				
X0326640	MOUNT BRCK PLP EX STR	EACH	3.000				
X0350800	BOLLARDS	EACH	10.000				
X4400198	CONC BARRIER REM SPL	FOOT	737.000				
X4403300	CONC MEDIAN REMOV	SQ FT	1,451.000				
X6700410	ENGR FLD OFF A SPL	CAL MO	30.000				
X7011012	TC-PROT ALT ROUTE	L SUM	1.000				
X7011015	TR C-PROT EXPRESSWAYS	L SUM	1.000				
X7013820	TR CONT SURVEIL EXPWY	CAL DA	630.000				
X7240205	REMOV SIGN COMPLETE	EACH	2.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60D61

State Job # - C-91-073-08
 PPS NBR - 1-75659-0100
 County Name - COOK- -
 Code - 31 - -
 District - 1 - -
 Section Number - 2424.2B-R

Project Number
 BHF-0389/004/

Route
 FAP 389

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X8700210	ECA C EPRTC 3C 4/0 4G	FOOT	261.000				
Z0006900	BR FLOOR REMOVAL	SQ YD	2,171.000				
Z0013798	CONSTRUCTION LAYOUT	L SUM	1.000				
Z0016200	DECK SLAB REP (PART)	SQ YD	50.000				
Z0029999	IMPACT ATTENUATOR REM	EACH	4.000				
Z0030070	IMP ATTEN SU NAR TL3	EACH	2.000				
Z0030280	IMP ATTN TEMP SUN TL3	EACH	1.000				
Z0030290	IMP ATTN TEMP SUW TL3	EACH	1.000				
Z0034100	MASONRY WALL CONSTR	SQ FT	385.000				
Z0053800	RIVET REMOV & REPL	EACH	2,888.000				
Z0076600	TRAINEES	HOUR	1,500.000		0.800		1,200.000
20100110	TREE REMOV 6-15	UNIT	9.000				
20100210	TREE REMOV OVER 15	UNIT	61.000				
20101100	TREE TRUNK PROTECTION	EACH	6.000				
20200100	EARTH EXCAVATION	CU YD	50.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
20201200	REM & DISP UNS MATL	CU YD	75.000				
20400800	FURNISHED EXCAV	CU YD	140.000				
20700220	POROUS GRAN EMBANK	CU YD	4.000				
21101625	TOPSOIL F & P 6	SQ YD	70.000				
21101685	TOPSOIL F & P 24	SQ YD	100.000				
25000115	SEEDING CL 1B	ACRE	0.220				
25000400	NITROGEN FERT NUTR	POUND	20.000				
25000500	PHOSPHORUS FERT NUTR	POUND	20.000				
25000600	POTASSIUM FERT NUTR	POUND	20.000				
25002300	TEMP SEEDING	ACRE	0.300				
25100105	MULCH METHOD 1	ACRE	0.300				
25200200	SUPPLE WATERING	UNIT	5.000				
28000400	PERIMETER EROS BAR	FOOT	305.000				
28000510	INLET FILTERS	EACH	22.000				
28100101	STONE RIPRAP CL A1	SQ YD	9.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
28200200	FILTER FABRIC	SQ YD	16.000				
31101400	SUB GRAN MAT B 6	SQ YD	334.000				
31101810	SUB GRAN MAT B 12	SQ YD	52.000				
35501316	HMA BASE CSE 8	SQ YD	280.000				
40600200	BIT MATLS PR CT	TON	0.300				
40603310	HMA SC "C" N50	TON	31.000				
44000500	COMB CURB GUTTER REM	FOOT	55.000				
44001500	BR SIDEWALK REM	SQ FT	3,878.000				
48101100	AGGREGATE SHLDS A 12	SQ YD	144.000				
50104800	REM EXIST CONC DECK	L SUM	1.000				
50157300	PROTECTIVE SHIELD	SQ YD	1,707.000				
50200100	STRUCTURE EXCAVATION	CU YD	5.500				
50300225	CONC STRUCT	CU YD	15.500				
50300255	CONC SUP-STR	CU YD	508.000				
50300260	BR DECK GROOVING	SQ YD	988.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
50300300	PROTECTIVE COAT	SQ YD	2,231.000				
50500105	F & E STRUCT STEEL	L SUM	1.000				
50500505	STUD SHEAR CONNECTORS	EACH	6,302.000				
50501120	STRUCT STEEL REMOV	L SUM	1.000				
50501130	STRUCT STEEL REPAIR	POUND	137,850.000				
50600300	CLEAN PAINT STEEL BR	L SUM	1.000				
50606400	C&D LEAD PT CL RES	L SUM	1.000				
50606600	C&D N LEAD PT CL RES	L SUM	1.000				
50800205	REINF BARS, EPOXY CTD	POUND	87,600.000				
50900200	STEEL RAIL TYPE 2399	FOOT	161.000				
50900500	ALUM RAILING	FOOT	553.000				
50901705	TUB THRBM RETRO RL BR	FOOT	150.000				
51500100	NAME PLATES	EACH	2.000				
52000110	PREF JT STRIP SEAL	FOOT	129.000				
58000100	MEMBRANE WATERPROOF	SQ FT	1,946.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
59000200	EPOXY CRACK INJECTION	FOOT	144.000				
60603800	COMB CC&G TB6.12	FOOT	308.000				
60623714	CONC MEDIAN SPL	SQ FT	1,451.000				
63100045	TRAF BAR TERM T2	EACH	1.000				
63100167	TR BAR TRM T1 SPL TAN	EACH	1.000				
63100215	TRAF BAR TERM T6 SPL	EACH	1.000				
63200310	GUARDRAIL REMOV	FOOT	178.000				
63801200	MOD GLARE SCRNSYS	FOOT	3,570.000				
66400505	CH LK FENCE 8	FOOT	380.000				
66409300	CH LK GATES 8X10 DBL	EACH	1.000				
67100100	MOBILIZATION	L SUM	1.000				
70101800	TRAF CONT & PROT SPL	L SUM	1.000				
70102550	TR CONT-PROT TEMP DET	EACH	4.000				
70103815	TR CONT SURVEILLANCE	CAL DA	50.000				
70106800	CHANGEABLE MESSAGE SN	CAL MO	280.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
70301000	WORK ZONE PAVT MK REM	SQ FT	15,783.000				
70400100	TEMP CONC BARRIER	FOOT	3,084.000				
70400200	REL TEMP CONC BARRIER	FOOT	1,375.000				
72000100	SIGN PANEL T1	SQ FT	162.000				
72000200	SIGN PANEL T2	SQ FT	84.000				
72400710	RELOC SIGN PANEL T1	SQ FT	27.000				
72400900	REMOV SIGN PANEL	EACH	15.000				
72800100	TELES STL SIN SUPPORT	FOOT	80.000				
73100100	BASE TEL STL SIN SUPP	EACH	6.000				
78000200	THPL PVT MK LINE 4	FOOT	1,508.000				
78000500	THPL PVT MK LINE 8	FOOT	323.000				
78000600	THPL PVT MK LINE 12	FOOT	762.000				
78003120	PREF PL PM TB LINE 5	FOOT	480.000				
78005100	EPOXY PVT MK LTR-SYM	SQ FT	109.200				
78005110	EPOXY PVT MK LINE 4	FOOT	9,956.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
78005120	EPOXY PVT MK LINE 5	FOOT	4,620.000				
78005140	EPOXY PVT MK LINE 8	FOOT	1,234.000				
78005150	EPOXY PVT MK LINE 12	FOOT	145.000				
78005180	EPOXY PVT MK LINE 24	FOOT	86.000				
78008200	POLYUREA PM T1 LTR-SY	SQ FT	116.000				
78008210	POLYUREA PM T1 LN 4	FOOT	9,754.000				
78008220	POLYUREA PM T1 LN 5	FOOT	3,950.000				
78008340	POLYUREA PM T2 LN 8	FOOT	2,145.000				
78008350	POLYUREA PM T2 LN 12	FOOT	693.000				
78008370	POLYUREA PM T2 LN 24	FOOT	128.000				
78200100	MONODIR PRIS BAR REFL	EACH	156.000				
78200410	GUARDRAIL MKR TYPE A	EACH	9.000				
78200530	BAR WALL MKR TYPE C	EACH	24.000				
78201000	TERMINAL MARKER - DA	EACH	1.000				
78300100	PAVT MARKING REMOVAL	SQ FT	12,625.000				

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80400100	ELECT SERV INSTALL	EACH	1.000				
80400200	ELECT UTIL SERV CONN	L SUM	1.000				
81012800	CON T 3 PVC	FOOT	750.000				
81013000	CON T 4 PVC	FOOT	50.000				
81100220	CON AT ST 3/4 PVC GS	FOOT	2,008.000				
81100320	CON AT ST 1 PVC GS	FOOT	5,629.000				
81100420	CON AT ST 1.25 GS PVC	FOOT	62.000				
81100510	CON AT ST 1.5 GS PVC	FOOT	268.000				
81100605	CON AT ST 2 PVC GALVS	FOOT	1,084.000				
81100705	CON AT ST 2.5 PVC GS	FOOT	1,293.000				
81100805	CON AT ST 3 PVC GALVS	FOOT	2,591.000				
84200500	REM EX LT UNIT SALV	EACH	9.000				
84400125	RELOC EX TEMP LT UNIT	EACH	9.000				
87000150	ECA C EPRTC 3C 6 #8G	FOOT	1,793.000				
87000200	ECA C EPRTC 3C 8 #10G	FOOT	4,145.000				

CONTRACT NUMBER

60D61

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 Illinois Procurement Code establishes the duty of all State chief procurement officers, State purchasing officers, 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. By execution of the Proposal Signature Sheet, the bidder indicates that each of the mandated assurances has 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 termination of the contract and the suspension or debarment of the bidder.

II. ASSURANCES

A. 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. The Department may terminate the contract if it is later determined that the bidder rendered a false or erroneous assurance, and the surety providing the performance bond shall be responsible for the completion of the contract.

B. Felons

1. The Illinois Procurement Code provides:

Section 50-10. Felons. Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any state agency 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.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-10.

C. Conflicts of Interest

1. The Illinois Procurement Code provides in pertinent part:

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 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 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

2. 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 and Executive Order Number 3 (1998). Information concerning the exemption process is available from the Department upon request.

D. Negotiations

1. The Illinois Procurement Code provides in pertinent part:

Section 50-15. Negotiations.

(a) 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.

2. 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.

E. Inducements

1. The Illinois Procurement Code provides:

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.

2. 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.

F. Revolving Door Prohibition

1. The Illinois Procurement Code provides:

Section 50-30. Revolving door prohibition. Chief procurement officers, associate procurement officers, State purchasing officers, 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.

2. 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.

G. Reporting Anticompetitive Practices

1. The Illinois Procurement Code provides:

Section 50-40. Reporting anticompetitive practices. When, for any reason, any vendor, bidder, contractor, chief procurement officer, State purchasing officer, 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 chief procurement officer.

2. 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.

H. Confidentiality

1. The Illinois Procurement Code provides:

Section 50-45. Confidentiality. Any chief procurement officer, State purchasing officer, 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.

2. 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.

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I. Insider Information

1. The Illinois Procurement Act provides:

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.

2. 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.

III. CERTIFICATIONS

A. 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. The Department may terminate the contract if it is later determined that the bidder rendered a false or erroneous certification, and the surety providing the performance bond shall be responsible for completion of the contract.

B. Bribery

1. The Illinois Procurement Code provides:

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 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, 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 1961.

- (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 shall contain a certification by the contractor that the contractor is not barred from being awarded a contract or subcontract under this Section. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

2. The bidder certifies that it is not barred from being awarded a contract under Section 50.5.

C. Educational Loan

1. Section 3 of the Educational Loan Default Act provides:

§ 3. 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.

2. 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.

D. Bid-Rigging/Bid Rotating

1. Section 33E-11 of the Criminal Code of 1961 provides:

§ 33E-11. (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. The State and units of local government shall provide the appropriate forms for such certification.

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(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.

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.

2. 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.

E. International Anti-Boycott

1. Section 5 of the International Anti-Boycott Certification Act provides:

§ 5. State contracts. 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.

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

F. Drug Free Workplace

1. 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.

2. The bidder certifies that if awarded a contract in excess of \$5,000 it will provide a drug free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance, including cannabis, is prohibited in the contractor's workplace; specifying the actions that will be taken against employees for violations of such prohibition; and notifying the employee that, as a condition of employment on such contract, the employee shall abide by the terms of the statement, and notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction.

(b) Establishing a drug free awareness program to inform employees about the dangers of drug abuse in the workplace; the contractor's policy of maintaining a drug free workplace; any available drug counseling, rehabilitation, and employee assistance programs; and the penalties that may be imposed upon employees for drug violations.

(c) Providing a copy of the statement required by subparagraph (1) to each employee engaged in the performance of the contract and to post the statement in a prominent place in the workplace.

(d) Notifying the Department within ten (10) days after receiving notice from an employee or otherwise receiving actual notice of the conviction of an employee for a violation of any criminal drug statute occurring in the workplace.

(e) Imposing or requiring, within 30 days after receiving notice from an employee of a conviction or actual notice of such a conviction, an appropriate personnel action, up to and including termination, or the satisfactory participation in a drug abuse assistance or rehabilitation program approved by a federal, state or local health, law enforcement or other appropriate agency.

(f) Assisting employees in selecting a course of action in the event drug counseling, treatment, and rehabilitation is required and indicating that a trained referral team is in place.

(g) Making a good faith effort to continue to maintain a drug free workplace through implementation of the actions and efforts stated in this certification.

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G. Debt Delinquency

1. The Illinois Procurement Code provides:

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

The contractor or bidder certifies that it, or any affiliate, is not barred from being awarded a contract under 30 ILCS 500. Section 50-11 prohibits a person from entering into a contract with a State agency 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 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 contractor further acknowledges that the contracting State agency may declare the contract void if this certification is false or if the contractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

H. Sarbanes-Oxley Act of 2002

1. The Illinois Procurement Code, Section 50-60(c), provides:

The contractor 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 for a period of five years prior to the date of the bid or contract. The contractor acknowledges that the contracting agency shall declare the contract void if this certification is false.

I. Addenda

The contractor or bidder certifies that all relevant addenda have been incorporated in to this contract. Failure to do so may cause the bid to be declared unacceptable.

J. Section 42 of the Environmental Protection Act

The contractor certifies in accordance with 30 ILCS 500/50-12 that the bidder or contractor is not barred from being awarded a contract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency 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 contractor acknowledges that the contracting agency may declare the contract void if this certification is false.

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

In accordance with the provisions of Section 30-22 (6) of the Illinois Procurement 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.

L. Executive Order Number 1 (2007) Regarding Lobbying on Government Procurements

The bidder hereby warrants and certifies that they have complied and will comply with the requirements set forth in this Order. The requirements of this warrant and certification are a material part of the contract, and the contractor shall require this warrant and certification provision to be included in all approved subcontracts.

RETURN WITH BID

M. Disclosure of Business Operations in Iran

Section 50-36 of the Illinois Procurement 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, offer or, 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, offer, or proposal 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.

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

Sections 20-160 and 50-37 of the Illinois Procurement 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 Illinois Procurement Code, and that it makes the following certification:

The undersigned business entity 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. A copy of the certificate of registration shall be submitted with the bid. The bidder is cautioned that the Department will not award a contract without submission of the certificate of registration.

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 Illinois Procurement Code. This provision does not apply to Federal-aid contracts.

TO BE RETURNED 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 Department may terminate the contract if it is later determined that the bidder rendered a false or erroneous disclosure, 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 Illinois Procurement Code provides that all bids of more than \$10,000 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.

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 400 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.

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. Subject individuals should be covered each by one form. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies. **The forms must be included with each bid or incorporated by reference.**

C. Disclosure Form Instructions

Form A: For bidders that have previously submitted the information requested in Form A

The Department has retained the Form A disclosures submitted by all bidders responding to these requirements for the April 24, 1998 or any subsequent letting conducted by the Department. The bidder has the option of submitting the information again or the bidder may check the following certification statement indicating that the information previously submitted by the bidder is, as of the date of submission, current and accurate. Before checking this certification, the bidder should carefully review its prior submissions to ensure the Certification is correct. If the Bidder checks the Certification, the Bidder should proceed to Form B instructions.

CERTIFICATION STATEMENT

I have determined that the Form A disclosure information previously submitted is current and accurate, and all forms are hereby incorporated by reference in this bid. Any necessary additional forms or amendments to previously submitted forms are attached to this bid.

(Bidding Company)



Signature of Authorized Representative

Date

Form A: For bidders who have NOT previously submitted the information requested in Form A

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 400 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 the second page of 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 \$102,600.00? YES ___ NO ___
3. Does anyone in your organization receive more than \$106,447.20 of the bidding entity's or parent entity's distributive income? (Note: Distributive income is, for these purposes, any type of distribution of profits. An annual salary is not 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 \$106,447.20? 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 on page 2 of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

Form B: 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.

D. Bidders Submitting More Than One Bid

Bidders submitting multiple bids may submit one set of forms consisting of all required Form A disclosures and one Form B for use with all bids. Please indicate in the space provided below the bid item that contains the original disclosure forms and the bid items which incorporate the forms by reference.

- The bid submitted for letting item _____ contains the Form A disclosures or Certification Statement and the Form B disclosures. The following letting items incorporate the said forms by reference:

RETURN WITH BID/OFFER

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 Illinois Procurement 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 \$10,000, 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.

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 \$106,447.20 (60% of the Governor's salary as of 3/1/09). (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 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 \$106,447.20, (60% of the Governor's salary as of 3/1/09) provide the name the State agency for which you are employed and your annual salary. _____

RETURN WITH BID/OFFER

- 3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 3/1/09) 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 the 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 \$106,447.20, (60% of the Governor's salary as of 3/1/09) 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 2 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 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 \$106,447.20, (60% of the Governor's salary as of 3/1/09) 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 \$106,447.20.00, (60% of the salary of the Governor as of 3/1/09) 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 the 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 \$106,447.20, (60% of the Governor's salary as of 3/1/09) 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 2 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/OFFER

(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 ___

APPLICABLE STATEMENT

This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page.

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

NOT APPLICABLE STATEMENT

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

RETURN WITH BID/OFFER

**ILLINOIS DEPARTMENT
OF TRANSPORTATION**

**Form B
Other Contracts &
Procurement 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 Illinois Procurement Act (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 \$10,000, 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

<input type="checkbox"/>	_____	_____
	Signature of Authorized Representative	Date

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. 60D61
COOK County
Section 2424.2B-R
Project BHF-389(004)
Route FAP 389
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. 60D61
COOK County
Section 2424.2B-R
Project BHF-389(004)
Route FAP 389
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 _____

(IF A JOINT VENTURE, USE THIS SECTION FOR THE MANAGING PARTY AND THE SECOND PARTY SHOULD SIGN BELOW) Attest _____
Signature _____
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.



Return with Bid

Division of Highways
Proposal Bid Bond
(Effective November 1, 1992)

Item No. _____

Letting Date _____

KNOW ALL MEN BY THESE PRESENTS, That We _____

as PRINCIPAL, and _____

_____ as SURETY, are 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 Article 102.09 of the "Standard Specifications for Road and Bridge Construction" in effect on the date of 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, submit a DBE Utilization Plan that is accepted and approved by the Department; 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 make the required DBE submission or 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 and the said SURETY have caused this instrument to be signed by

their respective officers this _____ day of _____ A.D., _____ .

PRINCIPAL

SURETY

(Company Name)

(Company Name)

By _____
(Signature & Title)

By: _____
(Signature of Attorney-in-Fact)

Notary Certification for Principal and Surety

STATE OF ILLINOIS,
County of _____

I, _____, a Notary Public in and for said County, do hereby certify that
_____ and _____
(Insert names of individuals signing on behalf of PRINCIPAL & SURETY)

who are each personally known to me to be the same persons whose names are subscribed to the foregoing instrument on behalf of PRINCIPAL and SURETY, appeared before me this day in person and acknowledged respectively, that they signed and delivered said instrument as their free and voluntary act for the uses and purposes therein set forth.

Given under my hand and notarial seal this _____ day of _____ A.D. _____

My commission expires _____

Notary Public

In lieu of completing the above section of the Proposal Bid Form, the Principal may file an Electronic Bid Bond. By signing the proposal and marking the check box next to the Signature and Title line below, 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

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:

Illinois Department of Transportation
District 1, Training Room A
201 West Center Court
Schaumburg, Illinois 60196

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. 60D61
COOK County
Section 2424.2B-R
Project BHF-389(004)
Route FAP 389
District 1 Construction Funds



Illinois Department of Transportation



NOTICE TO BIDDERS

- 1. TIME AND PLACE OF OPENING BIDS.** Sealed proposals for the improvement described herein will be received by the Department of Transportation at District 1, Training Room A, 201 West Center Court, Schaumburg, Illinois 60196 until 10:00 o'clock a.m., August 14, 2009. All bids will be gathered, sorted, publicly opened and read in Training Room A at the Department of Transportation's District 1, Training Room A, 201 West Center Court, Schaumburg, Illinois 60196, 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. 60D61
COOK County
Section 2424.2B-R
Project BHF-389(004)
Route FAP 389
District 1 Construction Funds**

Rehabilitation of the existing bridge carrying Congress Parkway over the south branch of the Chicago River (SN 016-2445) and bridge painting with other repairs to the structure carrying Congress Parkway between Chicago River and Post Office (SN 016-0460) all located in the city of 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

Gary Hannig,
Acting Secretary

INDEX
 FOR
 SUPPLEMENTAL SPECIFICATIONS
 AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2009

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used RECURRING SPECIAL PROVISIONS.

ERRATA Standard Specifications for Road and Bridge Construction (Adopted 1-1-07) (Revised 1-1-09)

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STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted January 1, 2007, the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," and the "Manual of Test Procedures for Materials" in effect on the date of invitation for bids, and the Supplemental Specifications and Recurring Special Provisions dated January 1, 2009 indicated on the Check Sheet included herein which apply to and govern the construction of FAP Route 389 (Congress Parkway), Project BHF-0389 (004), Section 2424.2B-R, Cook County, Contract #60D61. In case of conflict with any part or parts of said Specifications, the said Special Provisions shall take precedence and shall govern.

FAP Route 389 Congress Parkway over the South Branch of the Chicago River
Project BHF-0389 (004)
Section 2424.2B-R
County: Cook
Contract: 60D61

LOCATION OF PROJECT

The project is located in the City of Chicago, Cook County where Congress Parkway (FAP 389) crosses over the South Branch of the Chicago River.

DESCRIPTION OF PROJECT

The existing structure (S.N. 016-2445) is a dual double-leaf, trunnion type bascule bridge, carrying the eastbound and westbound traffic of Congress Parkway over the South Branch of the Chicago River. The proposed work consists of the removal and replacement of the existing open steel grid deck with an orthotropic closed deck system, including the removal and replacement of the existing reinforced concrete deck and sidewalks on approach spans. Other work includes floorbeam and truss repairs, aluminum barrier, remove and replace center breaks and rear breaks, bridge house rehabilitation, clean and paint existing structure. On the adjacent structure (S. N. 016-0460), repair girder K and provide guardrail along the outside edges of pavement/turn-outs. The mechanical scope will include removal of all tie shaft machinery, replace center lock machinery, replace machinery brakes, and replace barrier gates and traffic gates. The electrical scope will include main drive motor replacement, replace control system, provide PLC control system, replace facility lighting, replace power distribution panels and switchgear, replace cable and conduit routing, traffic signals, and provide emergency power. The civil scope will include maintenance of traffic, detour routing, alternate routes, access drive construction, drainage, erosion control, landscaping, signing, and pavement marking.

GENERAL

RECORD DRAWINGS

The Record Drawings for the existing Congress Parkway Bridge over the South Branch of the Chicago River are available at the Illinois Department of Transportation, District 1 Office, 201 West Center Court, Schaumburg, IL 60196. Contact: Brian Kuttab at 847-705-4431.

GENERAL CONSTRUCTION PROCEDURES

Description. The Contractor shall complete all construction operations according to the Contract Plans, applicable Standard Specifications, Detail Specifications, and as directed by Engineer. The Contractor shall not commence with construction operations until the required obligations for structural stability, verification of dimensions; procedure requirements, right-of-way, and systems coordination as detailed in these specifications are fulfilled to the satisfaction of the Engineer.

Structural Stability. The Contractor shall be responsible for the stability of the movable spans in all phases of construction. Prior to the replacement of steel members detailed on the Structural Drawings, the Contractor shall submit a construction procedure showing each step of the removal and replacement process. The Contractor shall also submit calculations sealed by a Licensed Structural Engineer registered in the state of Illinois showing that all members will remain stable and not become overstressed during any step of the removal and replacement process. All submittals shall be approved by the Engineer prior to replacement of steel members.

Verification of Dimensions. Plan dimensions and details relative to the existing structure have been taken from existing plans and are subject to nominal construction variations. It shall be the Contractor's responsibility to verify such dimensions and details in the field and make the necessary approved adjustments prior to construction or ordering of materials. Such variations shall be submitted to the Engineer and shall not be cause for additional compensation for a change in Scope of Work. However, the Contractor will be paid for the quantity actually furnished at the unit price bid for the work.

Procedure Requirements. The Contractor shall note that to accommodate the bridge rehabilitation of the movable spans, a shoring system has to be installed to ensure that the bascule bridge leaves remain locked in an open (or raised) position for the duration of the Bascule Bridge Rehabilitation. The temporary system details are not shown in the contract plans, but will need to be developed by the Contractor and submitted for approval.

To satisfy navigational requirements, the Contractor shall complete all construction operations detailed in the Contract Plans and Specifications while at least one of the bascule bridge leaves is secured in the open (or raised) position. Each of the leaves may need to be moved, re-positioned, re-balanced and shored at strategic stages during construction. When the bascule bridge leaves must be closed (or lowered) to facilitate a required construction operation or as directed by the Engineer, the Contractor shall submit bridge balancing and stress calculations sealed by a Licensed Structural Engineer

registered in the state of Illinois showing that the bridge will remain stable and not become overstressed during any stage of the bridge lowering (and subsequent raising) process. The Contractor shall note that intermediate bridge lowerings may be required for select truss member rehabilitation. All submittals shall be approved by the Engineer prior to a bridge lowering.

Bridge Operations. For the duration of the project, it will be the Contractor's responsibility to maintain the entire bridge and all its systems, by a qualified electrician to facilitate construction and to satisfy navigational requirements. The contractor shall provide adequate number of personnel and equipment for the safe operation of the bridge as directed by the Engineer. Currently, the City of Chicago Department of Transportation (CDOT) maintains and operates the bridge for the Illinois Department of Transportation (IDOT). At the onset of the project, a maintenance transfer will be conducted between the contractor, the Engineer and the City of Chicago. At that time, the City will cease operational and maintenance responsibility and turn it over to the Contractor, except that CDOT will open and close the bridges, or portions thereof, that are not under construction and will provide the necessary traffic control during the opening and closing of the bridges during the bridge lift season and any other times as requested by the Engineer. Attached FOR INFORMATION ONLY is a copy of the Spring 2009 Bridge Lift Schedule. . The Congress Parkway Bascule Bridge is raised and lowered approximately eighty (80) times a year. The 2010 and 2011 scheduled number of lifts is not yet available, but anticipated to be similar. The Contractor will maintain the entire bridge structure until the project is accepted by IDOT. The maintenance responsibility shall include, but not be limited to, greasing, adjusting, resetting breakers, protection of open gearing from debris, balancing, structural stability, etc. Attached FOR INFORMATION ONLY is CDOT's Operation Sequence for Congress Parkway Bridge.

Submittals. The Contractor shall be required to submit all required shop drawings and other required submittals in accordance with the Standard Specification Section 105.04 and other pertinent sections except that these submittals shall commence within 3 weeks after the execution of the contract. The Engineer will provide review comments within 30 calendar days after receipt of the "COMPLETE" submittal. All electrical and mechanical submittals shall include IDOT District 1 Submittal Record & Transmittal Form No. D1 OP0006. Upon completion of the work, the Contractor shall submit to the Engineer two (2) full size Mylar sets of As-Built Plans as well as two (2) electronic copies including an index and table of contents.

Basis of Payment. The cost of complying with the requirements of this specification section shall be considered included in the cost of the pay items in this contract.

FOR INFORMATION ONLY



Spring 2009 Bridge Lift Schedule

APRIL

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18 8 a.m.
19	20	21	22 9:30 a.m.	23	24	25 8 a.m.
26	27	28	29 9:30 a.m.	30		

MAY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2 8 a.m.
3	4	5	6 9:30 a.m.	7	8	9 8 a.m.
10	11	12	13 9:30 a.m.	14	15	16 8 a.m.
17	18	19	20 9:30 a.m.	21	22	23
24	25 MEMORIAL DAY	26	27	28	29	30 8 a.m.
31						

JUNE

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3 9:30 a.m.	4	5	6 8 a.m.
7	8	9	10 9:30 a.m.	11	12	13 8 a.m.
14	15	16	17 9:30 a.m.	18	19	20 8 a.m.
21	22	23	24 9:30 a.m.	25	26	27 8 a.m.
28	29	30				

Wednesday bridge lifts impact the downtown area between 11 a.m.-12:30 p.m.

Weekend bridge lifts impact the downtown area between 9:30-11:30 a.m.

FOR INFORMATION ONLY

CONGRESS STREET

BRIDGE: CONGRESS STREET LOCATION: 361 W. CONGRESS STREET PHONE: 744-4246
NUMBER OF OPERATORS: TWO-MAN EAST & WEST TOWER
TYPE: FOUR LEAF BASCULE BRIDGE (SINGLE DECK) - STATE OWNED
INITIAL POWER SOURCE: EDISON AC AND CTA DC
CENTERLOCK CONTROL LOCATION: WEST TOWER (TWO-CONTROL LEVERS)

OPERATIONAL SEQUENCE

TO RAISE:

1. MAIN CONTROL POWER SHOULD REMAIN ON. (L1)
- 2.&3. TRAFFIC SIGNALS DANGER BELLS
WHEN TRAFFIC IS AT A SLIGHT BREAK APPROACHING BENEATH THE POST OFFICE TUNNEL
(WEST SIDE), THEN;
4. OPERATE LEVER SWITCH (SLOWLY) FOR FAR ONCOMING ROADWAY GATE (EASTBOUND TRAFFIC)
5. OPERATE LEVER SWITCH (SLOWLY) FOR NEAR ONCOMING ROADWAY GATE (EASTBOUND
TRAFFIC)
6. OMIT—SIDEWALK GATE HANDLE HAS BEEN ELIMINATED.
7. OPERATE LEVER SWITCH FOR FAR OFFGOING ROADWAY GATE (WESTBOUND TRAFFIC)
8. OPERATE LEVER SWITCH FOR NEAR OFFGOING ROADWAY GATE (WESTBOUND TRAFFIC)
-WHEN TRAFFIC IS COMPLETELY STOPPED IN BOTH DIRECTIONS, THEN;
9. OPERATE LEVER SWITCH FOR BARRIER (RED LIGHT WILL CHANGE TO GREEN)
- 10.&11. OPERATE LEVER FOR CENTERLOCKS (FOR NORTH & SOUTH PAIR)
LOOK FOR CENTERLOCK FLAPS AT THE CENTER OF THE BRIDGE. THE (2) RED LIGHTS
WILL GO TO GREEN WHEN THE LOCKS ARE OUT. THEN THE HAND BRAKES SHOULD BE
RELEASED.
(EAST SIDE) ANNOUNCE ON THE P.A. SYSTEM: "PLEASE CLEAR THE BRIDGE, THE BRIDGE IS
GOING UP..., PLEASE CLEAR THE BRIDGE."
THE WEST OPERATOR HAS GIVEN THE OKAY TO RAISE:
- 12.&13. DEPRESS FOOT BRAKE & OPERATE CONTROLLER (TOWARDS YOU TO RAISE) & NOTCH
CONTROLLER ONE POINT AT A TIME UNTIL THE BRIDGE LEAF IS FULLY RAISED. WHEN
IN THE FULLY RAISED POSITION, PUT THE CONTROLLER BACK IN NEUTRAL & STEP BACK
OFF OF THE FOOT BRAKE.

WHEN THE OPERATOR WITH THE BEST VISUAL POINT (EAST TOWER FOR OUTBOUND RIVER TRAFFIC,
WEST TOWER FOR INBOUND RIVER TRAFFIC) HAS NOTIFIED THE OPPOSITE OPERATOR THAT
THE RIVER TRAFFIC HAS CLEARED THE DRAW, THEN: GIVE THE OKAY TO LOWER THE
BRIDGE.

TO LOWER:

- 12.&13. DEPRESS FOOT BRAKE & OPERATE THE CONTROLLER (AWAY FROM YOU TO LOWER) & NOTCH
CONTROLLER ONE POINT AT A TIME. PRIOR TO YOUR LEAF REACHING THE SLOWDOWN
(SEATING) POSITION, PUT THE CONTROLLER IN 2 POINTS. WHEN BOTH LEAVES HAVE
REACHED THEIR SEATING POSITION:
14. STEP OFF THE FOOT SWITCHES, RELEASE THE BYPASS BUTTONS AND RETURN THE
CONTROLLERS TO THE OFF POSITION, THEN:
-WHEN YOU SEE BOTH THAT LEAVES ARE COMPLETELY SEATED:
- 10.&11. OPERATE LEVERS FOR CENTERLOCKS INTO THE LOCK OR CLOSED POSITION. RED LIGHT
MUST SHOW WHEN THEY ARE FULLY IN.
- 9A. PULL UP HAND BRAKES
9. USE LEVER TO RAISE BARRIER (RED LIGHT WHEN FULLY RAISED)
-IF PROCESS IS NORMAL AT THIS POINT, WEST TOWER OPERATOR (USING

FOR INFORMATION ONLY

CONGRESS STREET (Continued)

HOUSE-TO-HOUSE PHONE) WILL GIVE OKAY TO CLEAR TRAFFIC TO EAST HOUSE OPERATOR,
THEN:

8. (RAISE) NEAR OFFGOING ROADWAY GATE (WESTBOUND TRAFFIC)
7. (RAISE) FAR OFFGOING ROADWAY GATE (WESTBOUND TRAFFIC)
6. OMIT
5. (RAISE) NEAR ONCOMING ROADWAY GATE (EASTBOUND TRAFFIC)
4. (RAISE) FAR ONCOMING ROADWAY GATE (EASTBOUND TRAFFIC)
- 3.&2. (TURN OFF) TRAFFIC SIGNAL DANGER BELLS

LEAVE MAIN CONTROL POWER ON! (CONSOLE)

FOR INSPECTIONAL CHECK OF CONSOLE THE FOLLOWING LAMPS SHOULD REMAIN ON AT ALL
TIMES:

MAIN CONTROL	(GREEN)
LI POWER	(AMBER)
NORMAL	(GREEN)
NORTH LEAF CHANNEL LAMP	(AMBER)
SOUTH LEAF CHANNEL LAMP	(AMBER)
PIER LAMP	(AMBER)
TIE SHAFT CLUTCH CLOSED	(GREEN)

LOG THE LIFT ONTO THE SWING SHEET & CHECK AGAIN TO SEE THAT ALL SWITCHES, LEVERS
& CONTROLS ARE IN THE NORMAL OR NEUTRAL POSITION AND THAT THE BRIDGEHOUSE IS SECURE.

MOVABLE BRIDGE SYSTEMS COORDINATION

The Contractor shall designate a Movable Bridge System Coordinator who shall coordinate all aspects of the Bascule Bridge Rehabilitation. The Movable Bridge System Coordinator shall be hired by, paid by, and held accountable to the Contractor. The Movable Bridge System Coordinator shall coordinate architectural, structural, mechanical and electrical systems and all interfaces between the systems to ensure that all construction operations can be implemented without delay to the Contract date of completion and without compromising the integrity of any portion of the existing or rehabilitated bascule bridge for the duration of the contract.

The Movable Bridge System Coordinator shall test all aspects of each system to ensure that they are operating correctly and to the satisfaction of the Engineer.

The Contractor shall submit credentials of the designated System Coordinator to the Engineer within ten (10) days after award of the contract. The System Coordinator must have a minimum of ten years experience with structural, mechanical and electrical systems along with previous construction experience on a minimum of three (3) movable bridges, with at least one being a bascule bridge.

The Movable Bridge System Coordinator shall review the Contract Plans, Standard Specifications, Special Provisions, and appropriate codes and standards as referred to in the Plans and Specifications and shall be responsible for identification of any apparent inconsistencies. The System Coordinator shall also be responsible for verification of dimensions in the filed and review of Contractor construction operations prior to the implementation of the respective work. The System Coordinator shall inform the Contractor and Engineer of potential construction interferences, apparent dimensional irregularities, and any other coordination inconsistencies and shall submit alternative which shall rectify the situation with minimum impact to the original Contract Documents and the respective systems involved.

The Movable Bridge System Coordinator shall review all shop drawings prior to submission to the Engineer for approval. The shop drawings shall also be signed by the coordinator prior to any submission.

RELATIONS WITH COAST GUARD

As required by the U.S. Coast Guard, the main branch of the Chicago River must remain navigable at all times. Accordingly, marine traffic shall not be interrupted by this project. The Contractor will be responsible for maintaining a navigable channel through the project area at all times. The Contractor is required to follow all rules and regulations of the U.S. Coast Guard. It is the Contractor's responsibility to keep the Coast Guard apprised of the work schedule. Minimum channel widths as shown on the plans must be maintained. If it is determined later that the barge inhibits vessel movements while placed inside the draw, then this determination may be revised. If the work barge needs to be moved and placed across the channel, away from the sides, at any time, then additional coordination will be necessary to ensure safe, clear passage for vessel traffic. If the bridge navigation lights are affected during the rehabilitation, then temporary navigation lights must be installed.

Additionally, required lighting must also be displayed on the work barge at night and during non-work hours. The Coast Guard office (Ninth Coast Guard District, 1240 E. Ninth Street, Room 2025, Cleveland, Ohio 44199-2060), must be notified at least 30 days prior to the start of the work or placement of a barge in the waterway. Authorization to perform the work and place equipment in the waterway will be provided at that time.

It is also the responsibility of the Contractor to coordinate with other work in progress in the vicinity of Congress Parkway Bridge, to minimize disruption to river navigation. Work must be coordinated to avoid “snaking” river traffic back and forth across the channel.

All work required to comply with Coast Guard closure and navigation requirements shall be included in the total contract.

CONSTRUCTION SITE ACCESS

The Contractor is required to provide access for the Engineer to all construction site locations and work activities taking place throughout the duration of the project. The access will be needed in order for the Engineer to perform the appropriate construction evaluation and inspection of the Congress Parkway Bascule Bridge and other pertinent work that is included in the contract.

EQUIPMENT SALVAGE

The Contractor shall provide the City of Chicago with 48 hour advance notice and provide a 72 hour window for the City maintenance crews to remove and salvage at their discretion any electrical or mechanical equipment called out for replacement.

INCENTIVE PAYMENT PLAN - INTERIM COMPLETION DATE (STAGE ONE)

The Contractor shall be entitled to an incentive payment for completing all contract items and safely opening all roadways to traffic in accordance with the requirements of the special provision “Interim Completion Date (Stage 1)”.

The incentive payment shall be paid at the rate of **\$10,000** per calendar day for completion of work, as specified above, each day prior to the completion date, as indicated in TABLE A. The maximum payment under this incentive plan will be limited to **15** calendar days.

TABLE A

<u>Date Completed</u>	<u>Incentive Payment</u>	<u>Date Completed</u>	<u>Disincentive Deduction</u>
October 16, 2010	\$150,000	October 31, 2010	0*
October 17, 2010	\$140,000	November 1, 2010	\$10,000
October 18, 2010	\$130,000	November 2, 2010	\$20,000
October 19, 2010	\$120,000	November 3, 2010	\$30,000
October 20, 2010	\$110,000	November 4, 2010	\$40,000
October 21, 2010	\$100,000	November 5, 2010	\$50,000
October 22, 2010	\$90,000	November 6, 2010	\$60,000
October 23, 2010	\$80,000	November 7, 2010	\$70,000
October 24, 2010	\$70,000	November 8, 2010	\$80,000
October 25, 2010	\$60,000	November 9, 2010	\$90,000
October 26, 2010	\$50,000	November 10, 2010	\$100,000
October 27, 2010	\$40,000	November 11, 2010	\$110,000
October 28, 2010	\$30,000	November 12, 2010	\$120,000
October 29, 2010	\$20,000	November 13, 2010	\$130,000
October 30, 2010	\$10,000	November 14, 2010	\$140,000
October 31, 2010	\$0*	November 15, 2010	\$150,000
		November 16, 2010	\$**

* The completion date specified in the contract.

**The disincentive deduction shall be charged until "Interim Completion Date (Stage 1)" Special Provision requirements are met.

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

Should the Contractor be delayed in the commencement, prosecution or completion of the work for any reason, there shall be no extension of the incentive payment completion date even though there may be granted an extension of time for completion of the work. No incentive will be paid if the Contractor fails to complete the work before the specified completion date. Failure by the Contractor to complete all work as specified above before **October 31, 2010** shall release and discharge the State, the Department and all of its officers, agents and employees from any and all claims and demands for payment of any incentive amount or damages arising from the refusal to pay an incentive amount.

INTERIM COMPLETION DATE (STAGE ONE)

The Contractor shall complete all items of work necessary to place traffic in the configurations as shown on "Winter Lane Configuration" staging plans by **October 31, 2010**. Including, but not limited to, the rehabilitating of the mechanical and electrical systems to the eastbound inbound structure to be fully and safely operational during the winter lane configuration.

FAILURE TO COMPLETE THE WORK ON TIME (STAGE ONE)

Should the Contractor fail to complete the work on or before the completion date or dates as specified in the Special Provision for "Interim Completion Date (Stage One)", 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.

INCENTIVE PAYMENT PLAN (FINAL COMPLETION DATE)

The Contractor shall be entitled to an incentive payment for completing all contract items and safely opening all roadways to traffic in accordance with the requirements of the special provision "Completion Date Plus Guaranteed Working Days".

The incentive payment shall be paid at the rate of **\$10,000** per calendar day for completion of work, as specified above, each day prior to the completion date, as indicated in TABLE A. The maximum payment under this incentive plan will be limited to **15** calendar days.

TABLE A

<u>Date Completed</u>	<u>Incentive Payment</u>	<u>Date Completed</u>	<u>Disincentive Deduction</u>
October 16,2011	\$150,000	October 31,2011	0
October 17,2011	\$140,000	November 1,2011	\$10,000
October 18,2011	\$130,000	November 2,2011	\$20,000
October 19,2011	\$120,000	November 3,2011	\$30,000
October 20,2011	\$110,000	November 4,2011	\$40,000
October 21,2011	\$100,000	November 5,2011	\$50,000
October 22,2011	\$90,000	November 6,2011	\$60,000
October 23,2011	\$80,000	November 7,2011	\$70,000
October 24,2011	\$70,000	November 8,2011	\$80,000
October 25,2011	\$60,000	November 9,2011	\$90,000
October 26,2011	\$50,000	November 10,2011	\$100,000
October 27,2011	\$40,000	November 11,2011	\$110,000
October 28,2011	\$30,000	November 12,2011	\$120,000
October 29,2011	\$20,000	November 13,2011	\$130,000
October 30,2011	\$10,000	November 14,2011	\$140,000
October 31,2011	\$0*	November 15,2011	\$150,000
		November 16,2011	**

* The completion date specified in the contract.

**The disincentive deduction shall be charged until work is completed.

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

Should the Contractor be delayed in the commencement, prosecution or completion of the work for any reason, there shall be no extension of the incentive payment completion date even though there may be granted an extension of time for completion of the work. No incentive will be paid if the Contractor fails to complete the work before the specified completion date. Failure by the Contractor to complete all work as specified above before **October 31, 2011** shall release and discharge the State, the Department and all of its officers, agents and employees from any and all claims and demands for payment of any incentive amount or damages arising from the refusal to pay an incentive amount.

FAILURE TO COMPLETE THE WORK ON TIME (FINAL COMPLETION DATE)

Should the Contractor fail to complete the work on or before the completion date or dates as specified in the Special Provision for "Completion Date Plus Guaranteed 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.

FINAL COMPLETION DATE PLUS GUARANTEED WORKING DAYS

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

"When a completion date plus guaranteed working days is specified, the Contractor shall complete all contract items and safely open all roadways and structures to traffic by 11:59 PM on, **October 31, 2011** except as specified herein.

The Contractor will be allowed to complete all clean-up work and punch list items within **(20)** guaranteed working days after the completion date for opening the roadway and structures 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 guaranteed working days allowed for clean up work and punch list items, such as bridge painting, surveillance items, bridge houses rehabilitation, underneath work which does not affect or impact the bridge and its operation. Temporary lane closures for this work, if required, may be allowed at the discretion and approval of the Engineer.

Article 108.09 of the Standard Specifications and the Supplemental Specifications 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.

UTILITY COORDINATION - CITY OF CHICAGO

Effective: September 30, 1985

Revised: November 1, 1996

The City of Chicago is to make adjustments to their street lighting and/or traffic signal facilities. The Contractor shall coordinate his work and cooperate with the City of Chicago in these adjustments.

This coordination and cooperation by the Contractor will not be paid for separately but shall be considered included in the costs of the contract.

STATUS OF UTILITIES TO BE ADJUSTED

Effective: January 30, 1987

Revised: July 1, 1994

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

Name of Utility	Type	Location	Estimate Dates for Start and Completion of Relocation or Adjustments
Commonwealth Edison Three Lincoln Center Fourth Floor Oakbrook Terrace, IL 60181-4260 Contact: Mr. John Prbich Program Manager, Public Relocation	Electric Cable (underground)	West side of Wacker (approx. 4' from eop) running parallel with roadway (Sta 101+00 to Sta 103+00) – runs eastward from Sta 103+00	Anticipated Conflict with construction of access drive – relocation/adjustment to be completed by March 1, 2010
City of Chicago Department of Water	Water Main (6")	West side of Wacker (approx. 8' from eop) running parallel with roadway (Sta 101+00 to Harrison Street)	Potential Conflict – Field Verify (any relocations/adjustments to be completed by April 1, 2010)

City of Chicago Chicago Department of Transportation	Storm Sewer	Crossing Wacker Drive at Sta 100+98 (running to Chicago River)	Potential Conflict – Field Verify (any relocations/adjustments to be completed by April 1, 2010)
	Storm Sewer	Crossing Wacker Drive at Sta 101+20 (running to Chicago River)	Potential Conflict – Field Verify (any relocations/adjustments to be completed by April 1, 2010)
Illinois Department of Transportation Region One/District One Contact: Mr. Mark Schwabe, IDOT Utility Coordinator	Electric Conduit (4")	Located within existing concrete barrier along Congress Parkway	Anticipated Conflict with removal and replacement of concrete barrier – final relocation to be completed by April 1, 2010 (temporary relocation needed during construction period)
Chicago Transit Authority (CTA) 567 West Lake Street PO Box 7598 Chicago, IL 60680-7598 Contact: Mr. David Heard, Manager, Construction Management Oversight 312-681-3862	600V DC Bridge Feed Cable	Crossing Congress Parkway near Wacker Drive	Potential Conflict – Field Verify (any relocations/adjustments to be completed by April 1, 2010)
Metropolitan Water Reclamation District of Greater Chicago 100 East Erie Street Chicago, Illinois 60611-3154 Contact: Mr. Hanif Munshi, Senior Civil Engineer 312-751-3184	30 foot diameter tunnel	Located along the South Branch of the Chicago River @ Congress Parkway	No Potential Conflict

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.

ENGINEER’S FIELD OFFICE TYPE A (SPECIAL)

This item shall consist of furnishing all utilities and maintaining in good condition the existing office space, located at 900 South Des Plaines Street, Chicago, IL 60607 which is located at the

northwest quadrant of the intersection of Taylor St. & Des Plaines St. in Chicago for the exclusive use of the Engineer and/or Authorized Representative(s). The office shall meet the requirements of Article 670.02 of the Standard Specifications with the following modifications:

1. The Contractor shall provide the following equipment and furnishing for the rear portion of the building that has been previously subdivided, as approved by the Engineer.
 - A. Twenty (20) desks with minimum working surface (1.1m x 750mm) each and twenty (20) non-folding office chairs with upholstered seats, backs & armrests.
 - B. Three (3), 4-post drafting tables with minimum top size of (950mm x 1.2m). The top shall be basswood or equivalent and capable of being tilted through an angle of 50 degrees. Three (3) adjustable height drafting stools with upholstered seats and backs shall also be provided.
 - C. Six (6) freestanding file cabinets with locks legal size, four drawers with an Underwriter's Laboratories insulated file device 350 degrees one hour rating.
 - D. One (1) equipment cabinet with lock of minimum dimension of 1100mm x 600mm x 750mm deep. The walls shall be of steel with a 2mm minimum thickness with concealed hinges and enclosed lock constructed in such a manner as to prevent entry by force. The cabinet assembly shall be permanently attached to a structural element of the office in a manner to prevent theft of the entire cabinet.
 - E. One (1) office-style refrigerator with a minimum size of 6.0 cubic feet with a top freezer unit.
 - F. Three (3) electric desk type tape printing calculators.
 - G. Ten (10) telephones and one (1) telephone answering machine (for the exclusive use by the Engineer). Six (6) telephone lines should be provided including one (1) telefax line and four (4) modem lines with high speed internet connection including the monthly service charges. The locations of the internet connection shall be as directed by the Engineer.
 - H. One (1) electric water cooler dispenser with supplies, cups and water bottles weekly service.
 - I. One (1) telecommunications fax machine, including maintenance and operating supplies. The fax machine shall use plain paper.
 - J. One (1) desktop dry process office copier (including maintenance and operating supplies capable of copying field books). Supply paper and trays for 215mm x 280mm; 215mm x 355mm; and 280mm x 430mm sizes. The copier shall be complete with automatic feeder, sorter and stapler.
 - K. The contractor shall install (4) paper towels dispensers in the existing sanitary facilities, as directed by the Engineer, including paper towels supply for the entire duration of the contract.

- L. The contractor shall provide and erect, as directed by the Engineer, one guide sign approx. 6 feet by 3 feet identifying the office and location.
 - M. The contractor shall repair all light fixtures to insure adequate operation and safe wiring and shall maintain and replace burnt light bulbs regularly.
2. The front portion of the space has also been previously subdivided and the Contractor, as approved by the Engineer, shall provide the following furnishings.
- A. One (1) desktop dry process office copier (including maintenance and operating supplies capable of copying field books). Supply paper and trays for 215mm x 280mm; 215mm x 355mm; and 280mm x 430mm sizes. The copier shall be complete with automatic feeder, sorter and stapler.
 - B. One (1) electric water cooler dispenser with supplies of cups and water service on a weekly basis.
 - C. Two (2) blackboards 1.2m by 1.8m.
 - D. One (1) microwave oven and one 10 cup coffee maker.
 - E. One (1) telephone answering machine.
 - F. Two (2) electric tape printing calculators.
 - G. One (1) office-style refrigerator with a minimum size of 6.0 cubic feet with a freezer unit.
 - H. One (1) first-aid cabinet fully equipped.
3. 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, paper towels, soap, toilet paper, and other necessary supplies. No additional compensation will be allowed for providing this service.
4. The existing interior walls will require one (1) coat of semi gloss paint, as directed by the Engineer, at no additional cost. Paint color to be approved in advance by the Engineer.
5. 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 windows shall be replaced at no additional cost.
6. Four (4) on-site sanitary facilities (bathrooms) shall be maintained.
7. The Contractor will be responsible for systems maintenance repairs which shall include the heating, cooling, sanitary and water distribution systems and light bulb replacements. One existing rooftop air conditioning or interior heating unit is to be replaced.

8. The (10) fire extinguishers meeting City of Chicago requirements shall be provided and wall mounted as directed by the Chicago Fire Department. A min. of 20 smoke detectors/carbon monoxide detectors (electric with battery backup) shall be installed within the office and shall be maintained in good working condition for the entire duration of the contract.
9. The Contractor will be responsible for snow removal from parking areas and sidewalks surrounding the building.
10. 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.
11. The contractor will be required to repair the 4 existing bathrooms including but not limited to fixtures repairs and or replacement, tiles repairs and proper drainage to insure proper operation and discharge into the sanitary sewer system.
12. The contractor shall repair roof leaks and shall seal around all windows and doors and repair/replace damaged/broken doors or windows as directed by the Engineer.
13. The contractor shall rekey all door locks (estimated 20) and provide a min. of 6 sets of additional keys for each rekeyed lock.
14. The contractor shall repair and maintain the existing HVAC system (2 units) to insure proper operation at all times including annual preventive maintenance by a qualified HVAC company.
14. The contractor shall resurface the existing back parking lot (70' x 250') of the Engineer's office including grading and shaping the existing stone base, filling depressions with stone aggregates to grade and placing a 3 inch layer of HMA binder course, Mix C, N 50 in accordance with the requirements of the Standard Specifications.

Basis of Payment: The office space, fully equipped as specified herein and accepted by the Engineer, will be paid for on a monthly basis or a percentage thereof until the space is released by the Engineer. The Contractor will be paid the contract bid price each month, provided the space is maintained, equipped, and utilities furnished. 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, charges, requirements and shall reflect the salvage value 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, when combined, in excess of \$150.

The Contractor shall be responsible for the repair and maintenance of the field office. No extra payment will be made for systems maintenance, repairs or for damages incurred as a result of vandalism, theft or other criminal activities.

MAINTENANCE OF TRAFFIC

MAINTENANCE OF ROADWAYS AND STRUCTURES

Beginning on the date that work begins on this project, the Contractor shall assume responsibility for normal maintenance of all existing roadways and structures 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.

TRAFFIC CONTROL PLAN

Effective: September 30, 1985

Revised: January 1, 2007

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:

701400	APPROACH TO LANE CLOSURE FREEWAY/EXPRESSWAY
701401	LANE CLOSURE FREEWAY/EXPRESSWAY
701400	APPROACH TO LANE CLOSURE FREEWAY/EXPRESSWAY
701401	LANE CLOSURE, FREEWAY/EXPRESSWAY
701411	LANE CLOSURE, MULTI-LANE AT ENTRANCE OR EXIT RAMP, FOR SPEEDS GREATER THAN OR EQUAL TO 45 MPH
701426	MULTI-LANE, INTERMITTENT OR MOVING OPERATION
701446	LANE CLOSURE, FREEWAY/EXPRESSWAY, TWO LANE CLOSURE
701606	URBAN LANE CLOSURE, MULTILANE, 2W WITH MOUNTABLE MEDIAN
701901	TRAFFIC CONTROL DEVICES
704001	TEMPORARY CONCRETE BARRIER
720001	SIGN PANEL MOUNTING DETAILS
720006	SIGN PANEL ERECTION DETAILS
720011	METAL POSTS FOR SIGNS, MARKERS & DELINEATORS

DETAILS:

TC-08	FREEWAY ENTRANCE AND EXIT RAMP CLOSURE DETAILS
TC-09	TRAFFIC CONTROL DETAILS FOR FREEWAY SINGLE & MULTI-LANE WEAVE
TC-12	MULTI-LANE FREEWAY PAVEMENT MARKING DETAILS
TC-13	DISTRICT ONE TYPICAL PAVEMENT MARKINGS
TC-16	PAVEMENT MARKING LETTERS AND SYMBOLS FOR TRAFFIC STAGING
TC-17	TRAFFIC CONTROL DETAILS FOR FREEWAY SHOULDER CLOSURES PARTIAL RAMP CLOSURES
TC-18	SIGNING FOR FLAGGING OPERATIONS AT WORK ZONE OPENINGS
TC-21	TYPICAL MARKING FOR CLOSING STATE HIGHWAYS
TC-22	ARTERIAL ROAD INFORMATIONAL SIGN
TC-24	CITY OF CHICAGO TYPICAL PAVEMENT MARKINGS

SPECIAL PROVISIONS:

INCENTIVE PAYMENT PLAN - INTERIM COMPLETION DATE (STAGE ONE)
 INTERIM COMPLETION DATE (STAGE ONE)
 FAILURE TO COMPLETE THE WORK ON TIME (STAGE ONE)
 INCENTIVE PAYMENT PLAN (FINAL COMPLETION DATE)
 FAILURE TO COMPLETE THE WORK ON TIME (FINAL COMPLETION DATE)
 FINAL COMPLETION DATE PLUS GUARANTEED WORKING DAYS
 MAINTENANCE OF ROADWAYS
 TRAFFIC CONTROL AND PROTECTION (SPECIAL)
 TRAFFIC CONTROL PLAN
 TRAFFIC CONTROL AND PROTECTION FOR TEMPORARY DETOUR
 TRAFFIC CONTROL AND PROTECTION FOR ALTERNATE ROUTE
 KEEPING THE EXPRESSWAY OPEN TO TRAFFIC
 FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC
 TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS)
 TRAFFIC CONTROL SURVEILLIANCE (EXPRESSWAYS)
 TRAFFIC CONTROL SURVEILLIANCE
 TEMPORARY INFORMATION SIGNING
 TRAFFIC CONTROL FOR WORK ZONE AREAS
 WORK RESTRICTIONS
 TYPE III TEMPORARY TAPE FOR WET CONDITIONS
 ADJACENT CONTRACT COORDINATION
 EPOXY PAVEMENT MARKING – BDE 80175
 IMPACT ATTENUATORS – BDE 80109
 IMPACT ATTENUATORS, TEMPORARY – BDE 80110
 NIGHTTIME WORK ZONE LIGHTING – BDE 80208
 NOTIFICATION OF REDUCED LANE WIDTH – BDE 80182
 POLYUREA PAVEMENT MARKING – BDE 80119
 PERSONAL PROTECTIVE EQUIPMENT – BDE 80209
 REFLECTIVE SHEETING ON CHANNELIZING DEVICES – BDE 80183
 THERMOPLASTIC PAVEMENT MARKINGS – BDE 80176

TRAFFIC CONTROL AND PROTECTION FOR TEMPORARY DETOUR

Effective: September 1, 1995

Revised: January 1, 2007

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.

Basis of Payment. This work will be paid for at the contract unit price each for TRAFFIC CONTROL AND PROTECTION FOR TEMPORARY DETOUR.

TRAFFIC CONTROL AND PROTECTION FOR ALTERNATE ROUTE

Alternate routes have been designated to provide motorists with different options to bypass the construction work zone segments along Congress Parkway. The Contractor shall furnish, erect, maintain and remove all applicable traffic control devices along the alternate route(s) according to the details shown in the plans.

Basis of Payment. This work will be paid for at the contract unit price per lump sum for TRAFFIC CONTROL AND PROTECTION FOR ALTERNATE ROUTE.

KEEPING THE EXPRESSWAY OPEN TO TRAFFIC

Effective: March 22, 1996

Revised: February 9, 2005

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: Eisenhower (Racine to Wells)

WEEKNIGHT	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
Friday	1-Lane	9:00 PM (Fri)	to	10:00 AM (Sat)
	2-Lane	11:00 PM (Fri)	to	7:00 AM (Sat)
Saturday	1-Lane	9:00 PM (Sat)	to	11:00 AM (Sun)
	2-Lane	11:00 PM (Sat)	to	8:00 AM (Sun)

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.

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. 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:

One lane or ramp blocked = \$2,000 per 15 minutes

Two lanes blocked = \$ 4,000 per 15 minutes

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: March 8, 1996

Revised: April 1, 2009

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 crash attenuator and arrow board. The attenuator vehicle shall be positioned in the live lane that is being closed or opened in advance of the workers and shall have the arrow panel directing traffic to the adjacent open lane. Failure to meet this requirement will subject to a Traffic Control Deficiency charge. The deficiency will be calculated as outlined in Article 105.03 of the Standard Specifications. Attenuator vehicles shall comply with Article 1106.02(g).

(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, 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.
 - 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. "Resumes" assemblies shall be eliminated. 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, and exit ramp gores. 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 all sections of the temporary concrete barrier wall. 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, 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:

$$\text{Adjusted contract price} = .25P + .75P [1+(X-0.1)]$$

Where: "P" is the bid unit price for Traffic Control and Protection

Where: "X" =		$\frac{\text{Difference between original and final sum total value of all work items for which traffic control and protection is required}}{\text{Original sum total value of all work items for which traffic control and protection is required.}}$	
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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 not 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.

TRAFFIC CONTROL SURVEILLANCE

The contractor shall provide a person with a vehicle to survey, inspect and maintain all temporary traffic control devices, including temporary signs, when a lane is closed to traffic or when hazards are present adjacent to or within 10 foot of the edge of pavement for more than 24 hours. This work shall accommodate the traffic control surveillance needed for the respective **local roads, detour, and alternate routes** as shown in the plans, and meet with the applicable portions of the Section 701 of the Standard Specifications.

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. The price shall include all labor and equipment necessary to provide the required inspection and maintenance on the **local roads, detour routes, and alternate routes** 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 2, 2007

Description.

This work shall consist of furnishing, installing, maintaining, relocating for various states of construction and eventually removing temporary informational signs. Included in this item may be ground mount signs, skid mount signs, truss mount signs, bridge mount signs, and overlay sign panels which cover portions of existing signs.

Materials.

Materials shall be according to the following Articles of Section 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	1092
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 701.14 and 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 the paved shoulder. A minimum of two (2) 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 be measured for payment in square feet (square meters) edge to edge (horizontally and vertically).

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 unit price per square foot (square meter) for TEMPORARY INFORMATION SIGNING.

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.

TRAFFIC CONTROL AND PROTECTION (SPECIAL)

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. This work shall be applicable to the traffic control and staging required along Wacker Drive and other cross roads adjacent to the Congress

Parkway improvement. IDOT Highway Standard 701606 Urban lane Closure, Multi-Lane, 2W with Mountable Median and other applicable highway standards will be used to accommodate the traffic control at these locations.

All traffic control (except traffic control pavement marking) indicated on the traffic control plan details, applicable standards and as specified in the Special Provisions will be measured for payment on a lump sum basis. Traffic control pavement markings will be measured per foot (meter).

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

WORK RESTRICTIONS

The Contractor shall not proceed with any construction operations, which would require permanent (24 hour per day) lane closures, lane shifts, and / or shoulder closures on the expressway, ramps, arterial routes and local streets prior to April 1, 2010.

The Engineer's written approval shall be obtained by the Contractor before proceeding with any work that interferes with traffic prior to the above date. Off-road work may proceed prior to the above date if approved by the Engineer.

TYPE III TEMPORARY TAPE FOR WET CONDITIONS

Effective: February 1, 2007

Description. This work shall consist of furnishing, installing, maintaining and removing Type III Temporary Pavement Marking Tape for Wet Conditions.

Type III Temporary Tape shall meet the requirements of Article 1095.06 of the Standard Specifications. Initial minimum reflectance values under dry and wet conditions shall be as specified in Article 1095.06. The marking tape shall maintain its reflective properties when submerged in water. The wet reflective properties shall be verified by a visual inspection method performed by the Department. The surface of the material shall provide an average skid resistance of 50 BPN when tested according to ASTM E 303.

Prior to application a surface preparation adhesive shall be applied to a clean, dry road surface. The pavement marking tape shall have a pre-coated pressure sensitive adhesive and shall require no activation procedures.

Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for WET REFLECTIVE TEMPORARY TAPE TYPE III of the line width specified, and at the contract unit price per square foot (square meter) for WET REFLECTIVE TEMPORARY LETTERS AND SYMBOLS.

ADJACENT CONTRACT COORDINATION

The Contractor shall coordinate construction staging and traffic control operations with adjacent construction contracts prior to and throughout the duration of the project. This includes the Congress Streetscape, Wacker Drive, and the I-290 resurfacing contracts, along with any other construction contract that may impact the staging operations of this contract. This effort is to help provide the most safe and effective staging environment throughout the project and at locations where adjacent projects impact the limits of staging. This work shall be included in the cost of Traffic Control and Protection (Expressways), which includes any adjustments to traffic control devices and/or staging needed to accommodate adjacent construction contract staging operations.

ROADWAY

EPOXY COATING ON REINFORCEMENT (DISTRICT ONE)

Effective: January 1, 2007

For work outside the limits of bridge approach pavement, all references in the Highway Standards and Standard Specifications for reinforcement, dowel bars, tie bars and chair supports for pavement, shoulders, curb, gutter, combination curb and gutter and median shall be epoxy coated, unless noted on the plan.

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

Effective: May 1, 2007

Revised: February 5, 2009

Add the following to the gradation tables of Article 1003.01(c) of the Standard Specifications:

FINE AGGREGATE GRADATIONS					
Grad No.	Sieve Size and Percent Passing				
	3/8	No. 4	No. 8	No. 16	No. 200
FM 23	100	6/	6/	8±8	2±2

FINE AGGREGATE GRADATIONS (metric)					
Grad No.	Sieve Size and Percent Passing				
	9.5 mm	4.75 mm	2.36 mm	1.16 mm	0.075 mm
FM 23	100	6/	6/	8±8	2±2

6/ For the fine aggregate gradations FA 23, the aggregate producer shall set the midpoint percent passing and a range of ± 10% shall be applied. The midpoint shall not be changed without Department approval.

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

“Gradation. The fine aggregate gradation for all HMA shall be FA1, FA 2, FA 20, FA 21 or FA 23. When Reclaimed Asphalt Pavement (RAP) is incorporated in the HMA design, the use of FA 21 Gradation will not be permitted.

USE OF RAP (DIST 1)

Effective: January 1, 2007

Revised: January 7, 2009

In Article 1030.02(g) of the Standard Specifications, delete the last sentence of the first paragraph in (Note 2).

Revise Section 1031 of the Standard Specifications to read:

“SECTION 1031. RECLAIMED ASPHALT PAVEMENT

1031.01 Description. Reclaimed asphalt pavement (RAP) results from the cold milling or crushing of an existing hot-mix asphalt (HMA) pavement. The Contractor shall supply written documentation that the RAP originated from routes or airfields under federal, state, or local agency jurisdiction. The contractor can also request that a processed pile be tested by the Department to determine the aggregate quality.

1031.02 Stockpiles. The Contractor shall construct individual, sealed RAP stockpiles meeting one of the following definitions. No additional RAP shall be added to the pile after the pile has been sealed. Stockpiles shall be sufficiently separated to prevent intermingling at the base. Stockpiles shall be identified by signs indicating the type and size as listed below (i.e. “Homogenous Surface”).

Prior to milling or removal of an HMA pavement, the Contractor may request the District to provide verification of the existing mix composition to clarify appropriate stockpile.

- (a) Homogeneous. Homogeneous RAP stockpiles shall consist of RAP from Class I, Superpave (High ESAL), HMA (High ESAL), or equivalent mixtures and represent:
1) the same aggregate quality, but shall be at least C quality; 2) the same type of crushed aggregate (either crushed natural aggregate, ACBF slag, or steel slag); 3) similar gradation; and 4) similar asphalt binder content. If approved by the Engineer, combined single pass surface/binder millings may be considered “homogenous” with a quality rating dictated by the lowest coarse aggregate quality present in the mixture.
- (b) Conglomerate 5/8. Conglomerate 5/8 RAP stockpiles shall consist of RAP from Class I, Superpave (High ESAL), HMA (High 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 5/8 RAP shall be processed prior to testing by crushing to where all RAP shall pass the 5/8 in. (16 mm) or smaller screen. Conglomerate 5/8 RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.

- (c) Conglomerate 3/8. Conglomerate 3/8 RAP stockpiles shall consist of RAP from Class I, Superpave (High ESAL), HMA (High 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 B quality. This RAP may have an inconsistent gradation and/or asphalt binder content prior to processing. All conglomerate 3/8 RAP shall be processed prior to testing by crushing to where all RAP shall pass the 3/8 in (9.5 mm) or smaller screen. Conglomerate 3/8 RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (d) Conglomerate Variable Size. Conglomerate variable size RAP shall consist of RAP from Class I, Superpave (High ESAL), HMA (High 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 B quality. This RAP may have an inconsistent gradation and/or asphalt binder content prior to processing. All conglomerate variable size RAP shall be processed prior to testing by crushing and screening to where all RAP is separated into various sizes. All the conglomerate variable size RAP shall pass the 3/4 in. (19 mm) screen and shall be a minimum of two sizes. Conglomerate variable size RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (e) Conglomerate "D" Quality (DQ). Conglomerate DQ RAP stockpiles shall consist of RAP from Class I, Superpave (High or Low ESAL), HMA (High or Low Esal), or equivalent mixtures. 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.
- (f) Non-Quality. RAP stockpiles that do not meet the requirements of the stockpile categories listed above shall be classified as "Non-Quality".

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

1031.03 Testing. When used in HMA, the RAP shall be sampled and tested either during or after 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).

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 pile either in-situ or by restock piling. 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 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.

- (a) Testing Conglomerate 3/8 and Conglomerate Variable Size. In addition to the requirements above, conglomerate 3/8 and variable size RAP shall be tested for maximum theoretical specific gravity (G_{mm}) at a 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).
- (b) Evaluation of Test Results. All of the extraction results shall be compiled and averaged for asphalt binder content and gradation and, when applicable G_{mm} . Individual extraction test results, when compared to the averages, will be accepted if within the tolerances listed below.

Parameter	Homogeneous/ Conglomerate	Conglomerate "D" Quality
1 in. (25 mm)		± 5 %
3/4 in. (19mm)		
1/2 in. (12.5mm)	± 8 %	± 15 %
No. 4 (4.75 mm)	± 6 %	± 13 %
No. 8 (2.36 mm)	±5 %	
No. 16 (1.18 mm)		± 15 %
No. 30 (600 μm)	± 5. %	
No. 200 (75 μm)	± 2.0 %	± 4.0 %
Asphalt Binder	± 0.4 % ^{1/}	± 0.5 %
G_{mm}	±0.02 % ^{2/}	
G_{mm}	±0.03 % ^{3/}	

1/ The tolerance for conglomerate 3/8 shall be ± 0.3 %.

2/ Applies only to conglomerate 3/8. When variation of the G_{mm} exceeds the ± 0.02 % tolerance, a new conglomerate 3/8 stockpile shall be created which will also require an additional mix design.

3/ Applies only to conglomerate variable size. When variation of the G_{mm} exceeds the ± 0.03 tolerance, a new conglomerate variable size stockpile shall be created which will also require an additional mix design.

If more than 20 percent of the individual sieves are out of the gradation tolerances, or if more than 20 percent of the asphalt binder content test results fall outside the appropriate tolerances, the RAP shall not be used in HMA unless the RAP representing the failing tests is removed from the stockpile. All test data and acceptance ranges shall be sent to the District for evaluation.

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)".

1031.04 Quality Designation of Aggregate in RAP. The quality of the RAP shall be set by the lowest quality of coarse aggregate in the RAP stockpile and are designated as follows.

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

1031.05 Use of RAP in HMA. The use of RAP in HMA shall be as follows.

- (a) Coarse Aggregate Size. The coarse aggregate in all RAP shall be equal to or less than the nominal maximum size requirement for the HMA mixture to be produced.
- (b) Steel Slag Stockpiles. RAP 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) surface mixtures only.
- (c) Use in HMA Surface Mixtures (High and Low ESAL). RAP stockpiles for use in HMA surface mixtures (High and Low ESAL) shall be either homogeneous or conglomerate 3/8 or variable size in which the coarse aggregate is Class B quality or better.
- (d) Use in HMA Binder Mixtures (High and Low ESAL), HMA Base Course, and HMA Base Course Widening. RAP stockpiles for use in HMA binder mixtures (High and Low ESAL), HMA base course, and HMA base course widening shall be homogeneous, conglomerate 5/8, or conglomerate 3/8, conglomerate variable size, in which the coarse aggregate is Class C quality or better.
- (e) Use in Shoulders and Subbase. RAP stockpiles for use in HMA shoulders and stabilized subbase (HMA) shall be homogeneous, conglomerate 5/8, conglomerate 3/8, conglomerate variable size, or conglomerate DQ.
- (f) The use of RAP shall be a contractor's option when constructing HMA in all contracts. When the contractor chooses the RAP option, the percentage of RAP shall not exceed the amounts indicated in the table for a given N Design.

Max Mix Rap Percentage

HMA Mixtures ^{1/3/}		Maximum % Rap	
Ndesign	Binder/Leveling Binder	Surface	Polymer Modified
30	30/40 ^{2/}	30	10
50	25/40 ^{2/}	15/25 ^{2/}	10
70	25/30 ^{2/}	10/20 ^{2/}	10
90	10/15 ^{2/}	10/15 ^{2/}	10
105	10/15 ^{2/}	10/15 ^{2/}	10

- 1/ For HMA Shoulder and Stabilized Sub-Base (HMA) N-30, the amount of RAP shall not exceed 50% of the mixture.
- 2/ Value of Max % RAP If 3/8 Rap or conglomerate variable size RAP is utilized.
- 3/ When RAP exceeds 20% the AC shall be PG58-22. However, when RAP exceeds 20% and is used in full depth HMA pavement the AC shall be PG58-28.

1031.06 HMA Mix Designs. At the Contractor's option, HMA mixtures may be constructed utilizing RAP material meeting the above detailed requirements.

RAP designs shall be submitted for volumetric verification. If additional RAP stockpiles are tested and found that no more than 20 percent of the results, as defined under "Testing" herein, are outside of the control tolerances set for the original RAP stockpile and HMA mix design, and meets all of the requirements herein, the additional RAP stockpiles may be used in the original mix design at the percent previously verified.

1031.07 HMA Production. The coarse aggregate in all RAP used shall be equal to or less than the nominal maximum size requirement for the HMA mixture being produced.

To remove or reduce agglomerated material, a scalping screen, crushing unit, or comparable sizing device approved by the Engineer shall be used in the RAP 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 the RAP control tolerances or QC/QA test results require corrective action, the Contractor shall cease production of the mixture containing RAP and either switch to the virgin aggregate design or submit a new RAP design. When producing mixtures containing conglomerate 3/8 or conglomerate variable size RAP, a positive dust control system shall be utilized.

HMA plants utilizing RAP shall be capable of automatically recording and printing the following information.

- (a) Drier Drum Plants

- (1) Date, month, year, and time to the nearest minute for each print.

- (2) HMA Mix number assigned by the Department
- (3) Accumulated weight of dry aggregate (combined or individual) in tons (metric tons) Accumulated weight of dry aggregate (combined or individual) in tons (metric tons) to the nearest 0.1 ton (0.1 metric ton)
- (4) Accumulated dry weight of RAP in tons (metric tons) to the nearest 0.1 ton (0.1 metric ton)
- (5) Accumulated mineral filler in revolutions, tons (metric tons), etc. to the nearest 0.1 unit.
- (6) Accumulated asphalt binder in gallons (liters), tons (metric tons), etc. to the nearest 0.1 unit.
- (7) Residual asphalt binder in the RAP material (per size) as a percent of the total mix to the nearest 0.1 unit.
- (8) Aggregate and RAP moisture compensators in percent as set on the control panel (Required when accumulated or individual aggregate and RAP are printed in wet condition).

(b) Batch Plants

- (1) Date, month, year, and time to the nearest minute for each print.
- (2) HMA mix number assigned by the Department.
- (3) Individual virgin aggregate hot bin batch weights to the nearest pound (kilogram)
- (4) Mineral filler weight to the nearest pound (kilogram).
- (5) Individual RAP Aggregate weight to the nearest pound (kilogram).
- (6) Virgin asphalt binder weight to the nearest pound (kilogram)
- (7) Residual asphalt binder of each RAP size 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.

1031.08 RAP in Aggregate Surface Course and Aggregate Shoulders. The use of RAP 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 "Other". The testing requirements of Article 1031.03 shall not apply.
- (b) Gradation. One hundred percent of the RAP material shall pass the 1 1/2 in. (37.5 mm) sieve. The RAP material shall be reasonably well graded from coarse to fine. RAP material that is gap-graded or single sized will not be accepted."

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

Effective : March 16, 2009

Revise Article 1004.03 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.

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

Use	Mixture	Aggregates Allowed
Class A	Seal or Cover	Gravel Crushed Gravel Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag Crushed Concrete
HMA All Other	Stabilized Subbase or Shoulders	Gravel Crushed Gravel Crushed Stone Crushed Sandstone Crushed Slag Crushed Concrete The coarse aggregate for stabilized subbase, if approved by the Engineer, may be produced by blending aggregates according to Article 1004.04(a).
HMA High ESAL Low ESAL	IL-25.0, IL-19.0, or IL-19.0L	Crushed Gravel Crushed Stone Crushed Sandstone Crushed Slag (ACBF)
HMA High ESAL Low ESAL	C Surface IL-12.5,IL-9.5, or IL-9.5L	Gravel (only when used in IL-9.5L) Crushed Gravel Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag (except when used as leveling binder)

Use	Mixture	Aggregates Allowed
HMA High ESAL	D Surface IL-12.5 or IL-9.5	<p>Crushed Gravel Crushed Stone (other than Limestone) Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag (except when used as leveling binder)</p> <p>Limestone may be used in Mixture D if blended by volume in the following coarse aggregate percentages: Up to 25% Limestone with at least 75% Dolomite. Up to 50% Limestone with at least 50% any aggregate listed for Mixture D except Dolomite. Up to 75% Limestone with at least 25% Crushed Slag (ACBF) or Crushed Sandstone.</p>
HMA High ESAL	E Surface IL-12.5 or IL-9.5	<p>Crushed Gravel Crushed Stone (other than Limestone and Dolomite) Crushed Sandstone</p> <p>No Limestone.</p> <p>Dolomite may be used in Mixture E if blended by volume in the following coarse aggregate percentages: Up to 75% Dolomite with at least 25% Crushed Sandstone, Crushed Slag (ACBF), or Crushed Steel Slag. When Crushed Slag (ACBF) or Crushed Steel Slag are used in the blend, the blend shall contain a minimum of 25% to a maximum of 75% of either Slag by volume. Up to 50% Dolomite with at least 50% of any aggregate listed for Mixture E.</p> <p>If required to meet design criteria, Crushed Gravel or Crushed Stone (other than Limestone or Dolomite) may be blended by volume in the following coarse aggregate percentages: Up to 75% Crushed Gravel or Crushed Stone (other than Limestone or Dolomite) with at least 25% Crushed Sandstone, Crushed Slag (ACBF), or Crushed Steel Slag. When Crushed Slag (ACBF) or Crushed Steel Slag are used in the blend, the blend shall contain a minimum of 25% to a maximum of 50% of either Slag by volume.</p>
HMA High ESAL	F Surface IL-12.5 or IL-9.5	<p>Crushed Sandstone</p> <p>No Limestone.</p> <p>Crushed Gravel, Crushed Concrete, or Crushed Dolomite may be used in Mixture F if blended by volume in the following coarse aggregate percentages: Up to 50% Crushed Gravel, Crushed Concrete or Crushed Dolomite with at least 50% Crushed Sandstone, Crushed Slag (ACBF), Crushed Steel Slag, or any Other Crushed Stone (to include Granite, Diabase, Rhyolite or Quartzite). When Crushed Slag (ACBF) or Crushed Steel Slag are used in the blend, the blend shall contain a minimum of 50% to a maximum of 75% of either Slag by volume.</p>

(b) Quality. For surface courses and binder courses when used as surface course, the coarse aggregate shall be Class B quality or better. For Class A (seal or cover coat), other binder courses, and surface course IL-9.5L (Low ESAL), the coarse aggregate shall be Class C quality or better. For All Other courses, the coarse aggregate shall be Class D quality or better.

(c) Gradation. The coarse aggregate gradations shall be as listed in the following table.

Use	Size/Application	Gradation No.
Class A-1, 2, & 3	3/8 in. (10 mm) Seal	CA 16
Class A-1	1/2 in. (13 mm) Seal	CA 15
Class A-2 & 3	Cover	CA 14
HMA High ESAL	IL-25.0 IL-19.0 IL-12.5 IL-9.5	CA 7 ^{1/} or CA 8 ^{1/} CA 11 ^{1/} CA 16 and/or CA 13 CA 16
HMA Low ESAL	IL-19.0L IL-9.5L	CA 11 ^{1/} CA 16
HMA All Other	Stabilized Subbase or Shoulders	CA 6 ^{2/} , CA 10, or CA 12

1/ CA 16 or CA 13 may be blended with the gradations listed.

2/ CA 6 will not be permitted in the top lift of shoulders.

HOT MIX ASPHALT – DENSITY TESTING OF LONGITUDINAL JOINTS (D-1)

Effective: January 1, 2007

Revised: January 8, 2009

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). This work shall be according to Section 1030 of the Standard Specifications except as follows.

Definitions:

Density Test Location: The station location used for density testing.

Density Test Site: Individual test site where a single density value is determined.

Density Reading: A single, one minute nuclear density reading.

Density Value: The density determined at a given density test site from the average of two “density readings”.

Quality Control / Quality Assurance (QC/QA)

1030.05(d) (3) add the following paragraphs:

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 two inches, from each pavement edge. For Example, on a four inch HMA lift the near edge of the nuclear gauge or core barrel shall be within four inches from the edge of pavement. The remaining 3 density test sites shall be equally spaced between the two edge readings. Documentation shall indicate whether the joint was confined or unconfined.

The joint density value shall be determined using either a correlated nuclear gauge or cores. When using a correlated nuclear gauge, two “density readings” shall be taken at the given density test site. The gauge shall be rotated 180 degrees between “density readings”. If the two “density readings” are not within 1.5 lb/cu ft (23 kg/cu m) then one additional “density reading” shall be taken. Additional “density readings” taken at a given site shall not be allowed to replace the original “density readings” unless an error has occurred (i.e. the nuclear gauge was sitting on debris).

1030.05(d) (4) Replace the density control limits table with the following:

DENSITY CONTROL LIMITS			
Mixture Composition	Parameter	Individual Test ^{2/}	Minimum Unconfined Test
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 %
All Other	Ndesign = 30	93.0 ^{1/} - 97.4 %	90.0 %

1/ 92.0 % when placed as first lift on an unimproved subgrade.

2/ “Density values” shall meet the “Individual Test” density control limits specified herein.

TEMPERATURE CONTROL FOR CONCRETE PLACEMENT (DISTRICT ONE)

Effective: May 1, 2007

Delete the second and third sentences of the second paragraph of Article 1020.14(a) of the Standard Specifications.

AGGREGATE FOR CONCRETE BARRIER (DISTRICT ONE)

Effective: February 11, 2004

Revised: January 1, 2007

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.”

BITUMINOUS PRIME COAT FOR HOT-MIX ASPHALT PAVEMENT (FULL DEPTH) (D-1)

Effective: May 1, 2007

Revise Article 407.06(b) of the Standard Specifications to read:

“A bituminous prime coat shall be applied between each lift of HMA according to Article 406.05(b) at a rate of 0.02 to 0.05 gal/sq yd (0.1 to 0.2 L/sq m), the exact rate to be determined by the Engineer.”

Revise the second paragraph of Article 407.12 of the Standard Specifications to read:

“Prime Coat will be paid for at the contract unit price per gallon (liter) or per ton (metric ton) for BITUMINOUS MATERIALS (PRIME COAT).”

CONCRETE BARRIER REMOVAL (SPECIAL)

This work shall consist of furnishing all materials, labor, and equipment necessary to remove existing concrete barrier wall at locations shown in the plans and in accordance with the applicable sections of the “Standard Specifications.” This work shall accommodate the interim staging plan and the proposed construction associated with the Congress Parkway Bridge rehabilitation work.

The construction methods needed to remove and dispose of the existing concrete barrier wall must meet with the approval of the Engineer and the applicable sections of the “Standard Specifications.” Any adjacent roadway or site features not called for removal, but damaged during this work, shall be replaced at no additional cost to the contract.

This work shall be paid for at the contract unit price per foot for CONCRETE BARRIER REMOVAL, including the cost for the removal and disposal of the existing concrete barrier wall.

CONCRETE MEDIAN REMOVAL

Description. This work shall consist of the removal and satisfactory disposal of an existing concrete median in accordance with the applicable sections of the “Standard Specifications.” Any adjacent roadway or site features not called for removal, but damaged during this work, shall be replaced at no additional cost to the contract.

Method of Measurement. This work will be measured for payment in place and the area computed in square feet.

Basis of payment. This work will be paid for at the contract unit price per square feet for CONCRETE MEDIAN REMOVAL, which price shall be payment in full for all labor, equipment and materials necessary to complete the work.

TRAFFIC BARRIER TERMINAL, TYPE 6 (SPECIAL)

Description. This work shall consist of furnishing and installing a Traffic Barrier Terminal, Type 6 (Special) at locations shown in the plans and in accordance with the detail Traffic Barrier Terminal, Type 6 (Special) and the applicable "Standard Specifications."

Basis of Payment. The work will be paid for at the contract unit price per each for TRAFFIC BARRIER TERMINAL, TYPE 6 (SPECIAL), which price shall be payment in full for all labor, equipment, and materials necessary to complete the work.

REMOVE SIGN COMPLETE

Description. This work shall consist of the removal and satisfactory disposal of existing signing as shown in the plans and in accordance with the applicable "Standard Specifications." The Contractor may use the removed signs for interim staging as approved by the Engineer.

Basis of Payment. This work will be paid for at the contract unit price per each for REMOVE SIGN COMPLETE, which price shall be payment in full for all labor, equipment and materials necessary to complete the work.

TEMPORARY CONCRETE BARRIER REMOVAL

Description. This work shall consist of removing temporary concrete barrier used during stage one and stage two construction in accordance with the applicable "Standard Specifications: and meeting with the approval of the Engineer. Any temporary concrete barrier located on the site prior to the start of construction shall also be removed as indicated in the plans.

For the winter configuration, the temporary concrete barrier shall be stored at an off-site location that does not interfere with traffic or violate any local, state, or federal laws. The location shall meet with the approval of the Engineer.

Basis of Payment. This work shall be paid for at the contract unit price per foot for TEMPORARY CONCRETE BARRIER REMOVAL. Installing temporary concrete barrier for all stages of construction shall be paid for separately at the contract unit price per foot for TEMPORARY CONCRETE BARRIER.

TEMPORARY FENCE (SPECIAL)

Description. This work shall consist of the erection, maintenance, and removal of a 4 foot high temporary construction fence (orange in color) with wood posts in accordance with the manufacturer's specifications and applicable "Standard Specifications."

The fence shall be placed along the perimeter of the Generator Access Drive in order to prevent the public from entering the work site. The locations proposed by the Contractor shall meet with the approval of the Engineer.

Once installed, the fence shall be kept upright and in a continuous pattern that satisfies the construction of the access drive area. The Contractor will be required to maintain and adjust the fence as needed throughout the duration of the project. Any damaged fencing shall be replaced by the Contractor as his/her own expense.

After the Temporary Fence is removed, the area shall be restored to match the site conditions previous to the start of construction. The cost of this restoration shall not be measured separately for payment, but shall be included in the cost for Temporary Fence (Special).

Method of Measurement. Temporary Fence will be measured for payment in feet along the top of the fence.

Basis of Payment. This work shall be paid for at the contract unit price per foot for TEMPORARY FENCE (SPECIAL).

IMPACT ATTENUATOR REMOVAL

Description: This work shall consist of the removal and satisfactory disposal of the existing impact attenuators at locations shown on the plans and in accordance with the applicable "Standard Specifications" and as approved by the Engineer.

Method of Measurement: This work shall be measured per each for each location.

Basis of Payment: This work shall be paid for at the contract unit price per each for IMPACT ATTENUATOR REMOVAL, which price shall include all labor and equipment needed to remove and dispose of the respective impact attenuators.

CONCRETE MEDIAN (SPECIAL)

Description: This work shall consist of constructing a concrete median surface to the lines, grades, and details shown on the plans and in accordance with the applicable "Standard Specifications." This median work shall occur at median locations that have been scarified and/or removed to accommodate interim staging operations.

Material: Materials for the concrete median, including portland cement concrete, preformed expansion joint filler, aggregate, reinforcement bars, construction joints and all other material necessary to construct the barrier shall be in accordance with Article 606.02.

Method of Measurement: This work will be measured in accordance with the provisions of Article 606.14 of the "Standard Specifications."

Basis of Payment: This work will be paid for at the contract unit price per square foot for CONCRETE MEDIAN (SPECIAL), which price shall include all materials, equipment and labor required to complete the work specified herein, including the cost of reinforcement bars and construction joints. Adjacent pavement and or roadway features damaged during this work shall be repaired and/or replaced at no additional cost to the contract.

TEMPORARY THRIE BEAM STEEL PLATE GUARDRAIL, TYPE D REMOVAL (SPECIAL)

Description: This work shall consist of the removal and satisfactory disposal of the Temporary Thrie Beam Steel Plate Guardrail utilized for staging of the project. The guard rail will be removed once it is no longer needed for staging operations. The guard rail will only be removed as directed by the Engineer.

Basis of Payment: This work shall be paid for at the contract unit price per foot for TEMPORARY THRIE BEAM STEEL PLATE GUARDRAIL, TYPE D REMOVAL (SPECIAL), which price shall include all labor and equipment needed to remove and dispose of the respective guard rail system.

STEEL RAILING REMOVAL

Description: This work shall consist of the removal and satisfactory disposal of the existing steel railings as shown on the plans and in accordance with the applicable "Standard Specifications." The steel railing is located along the sidewalks at the outer edges of the Congress Parkway Bridge.

Basis of Payment: This work shall be paid for at the contract unit price per foot for STEEL RAILING REMOVAL, which price shall include all labor and equipment needed to remove and dispose of the respective steel railings.

CHAIN LINK CANTILEVER SLIDE GATE (SPECIAL)

Description. This work shall consist of constructing a chain link cantilever slide gate and accessories in accordance with the details shown on the plans and the applicable portions of Section 664 of the Standard Specifications except as modified herein.

The slide gate shall be constructed to allow for an opening of 43 feet for entrance into the generator access drive.

Shop Drawings. Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate operation, hardware, and accessories. Indicate materials, shapes, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

Industrial Horizontal-Slide Gates.

- A. General: Comply with ASTM F 1184 for single slide gate types.
 1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
 2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1184 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F 1184 and the following:

1. Gate Fabric Height: 6'-0"
 2. Gate Opening Width: As indicated on plans.
 3. Frame Members:
 - a. Tubular Steel.
 4. Bracing Members:
 - a. Tubular Steel : 1.90 inches round
- C. Frame Corner Construction:
1. Welded frame.
- D. Horizontal-Slide Gate Post: According to ASTM F 1184.
1. Steel post, 4-inch diameter, Schedule 40 - 9.11-lb/ft. weight.
 2. Guide posts for Class 1 horizontal-slide gates equal the gate post height, 1 size smaller, but weight is not less than 3.11 lb/ft; installed adjacent to gate post to permit gate to slide in space between.
- E. Roller Guards: As required per ASTM F 1184 for Type II, Class 1 gates.
- F. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies, and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
1. Provide two new Knox Padlocks or approved equal. The padlocks shall be designed for exterior use in all weather conditions and the shackle must easily pass through the links in the chain specified below. The padlocks must be approved by the applicable fire protection districts. Provide a minimum of two keys for each padlock.
 2. Provide 3 feet of new ½" Grade 70 transport chain to be used to lock gate.

Gate Installation. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate all moving parts. The dimension between the bottom of the fabric and the ground shall be 3" nominal and may vary from 1" minimum to 5" maximum over uneven ground. Reinstall woven wire fence to the limits of the installed gates in accordance with the applicable portions of Section 665 of the Standard Specifications. Provide new woven wire fence unless the Engineer determines that the existing woven wire fence materials may be reused.

Adjusting. Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

Basis of Payment. This work will be paid for at the contract unit price per each for CHAIN LINK CANTILEVER SLIDE GATE (SPECIAL).

BOLLARDS

This work shall consist of constructing bollards at the locations shown in the plans and in accordance with the plan details, applicable manufacturer's details, and the applicable City of

Chicago standards. This work shall include all excavation and backfill, furnishing and placing a concrete foundation, re-grading, furnishing and installing a galvanized steel post with cap, and all labor, tools, and equipment necessary to complete the work as specified herein, including clean-up and restoration of the location.

The Bollards selected shall be a fixed galvanized steel type filled with concrete with a 6-inch round diameter. All bollards shall be yellow in color.

This work shall be paid for at the contract unit price per each for BOLLARDS, which includes all labor, materials, and equipment needed to install the fixed bollards as directed by the Engineer.

INLET FILTER CLEANING

This Special Provision revises Section 280 (Temporary Erosion Control) of the Standard Specifications for Road and Bridge Construction.

Add the following to Article 280.05:

Inlet Filter Cleaning shall consist of cleaning sediment out of a drainage structure inlet filter when directed by the Engineer. This cleaning work is to be periodically performed as directed by the Engineer, for the duration of the use of each drainage structure inlet filter assembly. The Engineer will be the sole judge of the need for cleaning, based on the rate that debris and silt is collected at each inlet filter location.

Cleaning of the inlet filter shall consist of inspecting, cleaning (includes removal and proper disposal of debris and silt that has accumulated in the filter fabric bag), by vactoring, removing and dumping, or any other method approved by the Engineer.”

Add the following to Article 280.07:

- (l) Inlet Filter Cleaning. This work will be measured for payment each time that the cleaning work is performed at each of the drainage structure inlet filter locations. “

Add the following at the end of Article 280.08:

- (m) Sediment Control, Drainage Structure Inlet Filter Cleaning. This work will be paid for at the contract unit price each for INLET FILTER CLEANING.”

TREE WELL

Wells shall be constructed to protect trees where the existing grade is being raised by grading in the vicinity of the trees. The Engineer shall make the final determination on where the tree wells will be installed. It may not be feasible to construct a tree well at every location. Therefore, the Contractor will only be paid for the tree wells that are constructed in the field.

This work consists of constructing tree wells as shown on the plans or as directed by the Engineer. Excavation and filling in the vicinity of trees which are to have tree wells or tree wall protection shall be delayed until the work under this item has progressed to an acceptable stage.

Materials for the construction of tree wells shall be stone or a segmental precast concrete block system as approved by the Engineer and meeting with the applicable sections of the Standard Specifications. If stone is used, it shall be rectangular in shape, field or quarry stone at least four fifths of the material shall have a minimum thickness of $\frac{1}{4}$ " and a minimum length of 1". Segmental precast concrete block system shall have a minimum thickness of $\frac{3}{4}$ " and a minimum length of 8 inches.

Materials for backfilling of the tree wells shall be approved by the Engineer and shall be course granular fill such as sand. Sand shall be approved by the Engineer.

Backfill for tree wells shall be topsoil as specified under Article 1081.05.

Geotextile for tree wells shall be of a geotextile material as specified under Article 1080.02.

Walls shall be constructed along the drip line of the existing tree or as approved by the Engineer.

The work shall be paid for at the contract unit price per each for TREE WELL, including the cost of all labor, materials, and equipment necessary to construct a stone and/or segmental block wall system as approved by the Engineer and meeting the applicable sections of the Standard Specifications.

ASBESTOS REMOVAL

Description: This work shall consist of the removal and proper disposal of asbestos material at the respective work areas located at the Southeast and Northeast Bridge Offices (37 West Congress Parkway, Chicago, Illinois) adjacent to the Congress Parkway Bascule Bridge over the South Branch of the Chicago River.

The work shall consist of removal and disposal of friable and non-friable asbestos from the location described above. All work shall be completed 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 the applicable Standard Specifications. Asbestos Bulk Sampling Report(s) have been developed regarding the collection of materials suspected of containing asbestos material. The Contractor will be able to use the information and findings included in the report(s) in order to assist in removing the asbestos material. The potential asbestos locations include roofs, interior and exterior windows, glazing, caulk, asphalt roof shingles, exterior sealant, flashing, sealant material, built-up roofing insulation, and other building materials. Asbestos Testing Reports will be available at the District One Office for the Contractor's review.

The work involved in the removal and disposal of friable and non-friable asbestos shall be performed by a Contractor or Sub-Contractor pre-qualified with the Illinois Capital development Board.

Notifications: The "Demolition/Renovation Notice" form, which can be obtained from the IEPA office, shall be completed and submitted to the address listed below at least ten days prior to commencement of any asbestos removal or demolition activity. Separate notices shall be sent for the asbestos removal work and the building demolition if they are done as separate operations.

Asbestos Demolition/Renovation Coordinator
Illinois Environmental Protection Agency
Division of Air Pollution Control
P.O. Box 19276
Springfield, Illinois 62794-9276
(217) 785-1743

Notices shall be updated if there is a change in the starting date or the amount of asbestos changes by more than 20 percent.

The following documentation must be submitted to the Engineer prior to starting work:

- A. Submit documentation 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 protection measures.
- B. Submit manufacturer's certification stating that vacuums, ventilation equipment, and other equipment required to contain airborne fibers conform to ANSI 29.2.
- C. 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.
- D. 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 designed landfill).
- E. Submit a list of penalties, including liquidated damages, incurred through non-compliance with asbestos abatement project specifications.
- F. The Contractor shall provide a Shipping Manifest as approved by the Engineer.
- G. Submit a detailed plan of the procedures proposed for use in complying with the requirements of this specification.

The following is a list of submittals that must 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.
4. Submit results of any bulk material analysis and air sampling data collecting during the course of the abatement, including results of any on-site testing by any federal, state, or local agency.

The following is a list of Insurance Certifications that the Contractor must obtain:

1. General liability insurance for personal injury, occupational disease, and sickness or death, and property damage.
2. Workmen's Compensation Insurance coverage.
3. Supply insurance certificates as specified by the Department

Prior to starting work, the Contractor shall provide documentation that supports past experience and knowledge of all requirements associated with asbestos removal and disposal (previous projects and client feedback, staff experience, training records, etc.).

The Contractor shall comply with all local, State, and Federal abatement air monitoring requirements.

Method of Measurement: This work shall be paid for at the contract unit price per lump sum for **ASBESTOS REMOVAL**, including all labor, materials, transportation, safety measures, and other expenses regarding the removal and proper disposal of asbestos material associated with the proposed work included in the contract.

STRUCTURES

CONCRETE PARAPET, 34 INCH F SHAPE (MODIFIED)

Description: This work shall consist of constructing a single face concrete barrier to the lines, grade and details shown on the plans in accordance with Section 637 of the "Standard Specifications", and the applicable highway details and standards located within the plan set.

Material: Materials for the barrier, including portland cement concrete, preformed expansion joint filler, reinforcement bars, construction joints and all other material necessary to construct the barrier shall be in accordance with Article 637.02.

Method of Measurement: This work will be measured in accordance with the provisions of Article 637.11 of the Standard Specifications.

Basis of Payment: This work will be paid for at the contract unit price per foot for **CONCRETE PARAPET, 34 INCH F SHAPE (MODIFIED)**, which price shall include all materials, equipment and labor required to complete the work specified herein, including the cost of reinforcement bars and construction joints.

CONCRETE PARAPET TRANSITION, 34 INCH F SHAPE (MODIFIED)

Description: This work shall consist of constructing a concrete barrier transition to the lines, grade and details shown on the plans and in accordance with the applicable "Standard Specifications." This work occurs west of the bridge and transitions the proposed concrete barrier into the existing concrete wall at the old post office.

Material: Materials for the concrete barrier transition, including portland cement concrete, preformed expansion joint filler, aggregate, reinforcement bars, construction joints and all other material necessary to construct the barrier shall be in accordance with Article 606.02.

Method of Measurement: This work will be measured in accordance with the provisions of Article 606.14 of the "Standard Specifications."

Basis of Payment: This work will be paid for at the contract unit price per foot for **CONCRETE PARAPET TRANSITION, 34 INCH F SHAPE (MODIFIED)**, which price shall include all materials, equipment and labor required to complete the work specified herein, including the cost of reinforcement bars and construction joints.

TEMPORARY THRIE BEAM STEEL PLATE GUARDRAIL, TYPE D (SPECIAL)

Description: This work shall consist of installing a Thrie Beam Steel Guardrail as shown in the plans and details. The guardrail, which ties to the bridge deck, will be used to accommodate the staging plan associated with the project.

Basis of Payment: This work will be paid for at the contract unit price per foot for **TEMPORARY THRIE BEAM STEEL PLATE GUARD RAIL, TYPE D (SPECIAL)**, which price shall include all materials, equipment and labor required to complete the work specified herein.

STRUCTURAL STEEL REMOVAL

Description. This item of work shall consist of furnishing all the necessary labor, tools, equipment, materials and incidentals for safely performing all work to remove and legally dispose of existing structural steel on the movable leaves and fixed spans of the Bascule Bridge structure as indicated on the Plans and as directed by the Engineer.

All work shall conform to the applicable requirements of Section 501 of the Standard Specification and as specified herein.

The removal work under this item shall include, but is not limited to, stringers on the east and west fixed spans, stringers on the movable span, bracing members, gusset plates, connection angles, rear and center breaks, floorbeams, enclosure wall supports, walkway, sidewalk brackets, service platforms and other structural steel members requiring removal or modification for the installation of new structural elements, as shown on the Plans and as specified herein. It is the intent of this item to include all steel required to make rehabilitation and/or replacements. Furthermore, this item shall include removal of existing rivets or bolts, as required for the removal of the existing structural steel and the installation of new structural steel.

Steel to be removed for rehabilitation shall be as shown on the Plans or as directed by the Engineer. The Plans have been prepared from a survey of the existing conditions and are reasonably complete in this respect. However, it may be found when the work is underway, that more deterioration exists than was indicated in the survey. Accordingly, the Contractor shall remove such additional members or parts, in excess of those shown on the Plans as designated by the Engineer. No additional compensation shall be made to the Contractor. All work mentioned shall be incidental to this pay item.

Submittals. The Contractor shall submit, to the Engineer for review, his/her proposed method and equipment to be employed for the removal of designated structural steel on the fixed spans and the movable leaves of the Bascule Bridge.

The submittal shall include a written description of the proposed sequence of removal and the methods to be employed in the removal operations. Furthermore, the submittal shall include drawings and details of the sequence depicting removal of existing steel and locations of any temporary supports, shoring, or bracing, including the anticipated loads and the step-by-step removal procedure. The Contractor shall be responsible to ensure that the removal procedure results in a safe and stable structure at all times and to comply with all safety requirements established and required by all City, State, and Federal laws, and any other applicable codes or other regulations.

Removal Requirements. The existing structural steel shall be removed in the areas indicated on the Plans and at the locations directed by the Engineer.

Removal of materials shall be performed in such a manner as to leave the remaining structure undamaged. Any damage to portions of the structure indicated to remain in place shall be repaired or replaced by the Contractor at no additional expense to IDOT. The Engineer shall determine the degree of reparation and approval of said work. At all interfaces between steel to be removed and steel to remain, the member to be removed shall be cut 6" offset from the connection.

The Contractor shall coordinate the complete or partial removal of main members and/or reinforcing main members with the erection of their replacement or reinforcing members. Portions of the existing structure to remain in place and carry loads shall be supported as required and to the satisfaction of the Engineer prior to removal of the designated areas and sections of structural steel. The Contractor shall install temporary supports or connections to maintain the fixed spans and the movable leaves of the bridge in a stable and safe condition until the new structural steel member is in place. Existing equipment, machinery, conduits and other accessories attached to the structural steel shall be removed as directed by the Engineer at no additional cost to IDOT.

Furthermore, the Contractor shall support the structure in such a manner as to prevent damage to the existing structure. No shoring or support members shall interfere with the operation of any

elements required to remain functional during this work. The Contractor shall assume full responsibility for damage to any components of the Bridge including the movable leaves, fixed structures, machinery and electrical equipment that may occur as a result of the Contractor's activities. Any damage to the structures to remain in place or unauthorized removal shall be repaired or replaced by the Contractor at no additional expense to IDOT. The Engineer shall determine the degree of reparation and approval of said work.

Where existing equipment, machinery, conduits, and other accessories that are to remain in place, either permanently or temporarily, the Contractor shall provide all temporary support and protection from damage by other work.

The Contractor is also cautioned that in replacing and reinforcing deteriorated movable and fixed structural members, the members may, in addition to shoring, require jacking to relieve internal stresses within the steel members. The Contractor shall submit shop drawings, sealed by a Licensed Structural Engineer, registered in the State of Illinois, showing all members to be shored and stress relieved and details and procedures for the operations to the Engineer for review, as required by Section 105 of the Standard Specifications.

The use of oxyacetylene or oxy-MAPP gas cutting is not permitted, although arc gouging is permissible to cut out the central core of rivets if no cutting of the hole ID occurs. The rivet shall then be forced out by mechanical means. If cutting of the hole ID does occur, the hole shall be redrilled to the next larger-sized bolt which eliminates any cuts caused by arc gouging.

All materials removed shall become the property of the Contractor and shall be disposed of by the Contractor off site in a lawful manner satisfactory to the Engineer.

The Contractor shall also provide protection to the satisfaction of the Engineer for river traffic, which may be endangered by falling material during removal operations.

Method of Measurement. No separate measurement shall be made for the work under this item.

Any material used for protection, or any supports for structural steel to remain, or temporary working platforms for structural steel removal, shall not be measured separately for payment, and shall be considered included in this item.

Basis of Payment. The work under this item shall be paid at the Contract Lump Sum Price for **STRUCTURAL STEEL REMOVAL.**

STRUCTURAL STEEL REPAIR

Description. This item shall consist of furnishing, fabricating, transporting, erecting and painting all structural steel shapes, plates and fasteners which are required in addition to the replacement of existing rivets and bolts as shown on the plans and as required for the rehabilitation of the movable spans, approach and fixed spans. These items shall consist of, but not be limited to, floorbeam, stringers, girders, truss member components, all components for members identified for rehabilitation, and other structural and non-structural steel items, including all appurtenant and collateral work as shown on the Plans, called for in the Specifications or as directed by the Engineer. This Work shall include structural steel items, tie plates, tie angles, high-strength bolts, and connection fasteners. All structural steel work shall be in accordance with the applicable requirements of Sections 505 and 506 of the Standard Specifications and as specified herein.

The Contractor shall be responsible for verifying and obtaining all field measurements as required for the proper dimension, details and fabrication of new structural steel to fit existing conditions. All dimensions and conditions shall be verified by the Contractor prior to submittal of shop drawings and the ordering of materials. The Engineer shall be provided with copies of field notes and field dimensions to facilitate the review of shop drawings. The original field notes and field dimensions shall become the property of IDOT at the end of the Contract.

The work under this item shall also include furnishing all labor, materials, tools and equipment necessary to remove, straighten and reinstall all bent structural steel as shown on the plans and as directed by the Engineer. Straightening of structural steel to be done without the removal of the members shall also be included under this item.

The use of oxyacetylene or oxy-MAPP gas cutting is not permitted, although arc gouging is permissible to cut out the central core of rivets if no cutting of the hole ID occurs. The rivet shall then be forced out by mechanical means. If cutting of the hole ID does occur, the hole shall be redrilled to the next larger-sized bolt which eliminates any cuts caused by arc gouging. Removal of rivets required for member replacement shall be performed in such a manner so as not to damage the existing structural steel that is to remain in place. If the structural steel is damaged, the additional costs for material and labor necessary to restore the member or member components to its original condition will not be measured for payment but will be done the Contractor's expense.

Rivets or bolts removed for erection of members or member components shall be replaced with new high-strength bolts of the same nominal diameter, unless noted otherwise or as directed by the Engineer.

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show the method of joining, the thickness of metal, profiles as well as all materials and shall also contain full and complete information regarding joints and fastenings.

The Contractor shall furnish Plans and working drawings for fabricating and erecting structural steel as required by the Engineer. Erection drawings shall show the required tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Method of Measurement. The net weight of structural steel, furnished, fabricated, and accepted by the Engineer shall be measured for payment in pounds. Shop painting, the weights of bolts, nuts, washers and cutting or drilling of holes shall not be measured separately for payment, and shall be considered included in this item. Changes to the Plan quantities shall be submitted in writing to the Engineer for approval prior to ordering material. All material damaged in shipping, storage, handling or misfabrications shall be replaced by the Contractor at his/her expense.

Basis of Payment. Structural steel and other new materials complying with the requirements of this item, furnished, delivered and erected complete in place according to the specifications, shall be paid for at the Contract unit Price per pound for **STRUCTURAL STEEL REPAIR**.

BRIDGE FLOOR REMOVAL

Description. This item shall consist of removing and legally disposing of the existing bridge decks on the movable leaves of the Bascule Bridge as indicated on the Plans and as directed by the Engineer. All Work shall comply with the applicable requirements of Section 501 of the Standard Specifications, as specified herein.

The deck removal shall include all steel roadway grating, plates and related steel attachment, concrete filled steel grating and all other related items included as part of the bridge deck.

All materials removed shall become the property of the Contractor and shall be disposed of by the Contractor off the site and in a lawful manner acceptable to the Engineer.

Removal Requirements. The Contractor shall submit, to the Engineer for review, his/her proposed method and equipment to be employed in the removal of the movable bridge decks.

Removal of the bridge decks shall be done in a manner and sequence consistent with the sequence of the rehabilitation of the Bridge.

When removing the existing roadway bridge deck, care shall be taken as to not damage existing structural steel members, adjacent surfaces or materials or adjacent construction which are to remain. The Contractor shall be responsible for all expense and/or costs of repairing or replacing damaged steel members, surfaces, materials or construction caused during the removal operations. Repairs shall be done as directed by the Engineer and may include grinding, welding and/or member replacement depending upon location and severity of the damage.

The Contractor shall include all protection as required to prevent any materials produced during bridge deck removal from falling into the River or on the existing equipment below such demolition operations.

Method of Measurement. Bridge floor removal will be measured for payment in place and area computed in square yards of bridge floor to be removed.

Basis of Payment. This Work will be paid for at the Contract unit Price per square yard for **BRIDGE FLOOR REMOVAL**, which price shall be payment in full for all labor, tools, equipment and incidentals and performing all work to complete the bridge roadway removal as indicated on the Plans, as specified herein, and as directed by the Engineer.

FURNISHING AND ERECTING ORTHOTROPIC DECK

Description. This Item shall consist of furnishing, fabrication, shop assembly, cleaning, shop painting, storing, transporting and erecting the steel orthotropic deck as indicated on the Plans and as directed by the Engineer. All work shall comply with the applicable requirements of Section 507 of the Standard Specifications and as specified herein. Orthotropic deck referred to herein applies to both steel orthotropic deck (roadway and sidewalk) in the movable spans unless explicitly stated.

The Contractor shall be responsible for verifying and obtaining all field measurements as required for the proper dimension, details and fabrication of new structural steel to fit existing conditions. All dimensions and conditions shall be verified by the Contractor prior to submittal of shop drawings and the ordering of materials. The Engineer shall be provided with copies of field notes and field dimensions to facilitate the review of shop drawings. The original field notes and field dimensions shall become the property of IDOT at the end of the Contract.

Submittals. The Contractor shall submit complete shop drawings showing the fabrication of all steel orthotropic deck on the project and complete erection and staging drawings for the review and approval of the Engineer.

The erection and staging drawings shall show in considerable detail the locations of structural supports, relationship of all units of steel orthotropic deck, installed in initial positions, positions of lifting equipment used for the erection and detailed procedures describing the erection and securing deck units.

The submittal shall include a written description of the proposed sequence of erection and methods to be employed in the erection operations. Furthermore, the submittal shall include drawings and details of the sequence of installing and location of any temporary supports or bracing, the anticipated loads and step-by-step-procedure. The Contractor shall be responsible to ensure that the erection procedure results in a safe and stable structure at all times and to comply with all safety requirements as required by all City, State and Federal Laws, codes or other regulations.

Materials. A. The steel substrate for the roadway shall be defined as those ½-inch deck plate areas between faces of permanent barrier receiving wearing surface application. The steel substrate for the sidewalk shall be defined as the 5/16-inch deck plate receiving pedestrian wearing surface application. Steel substrate shall be prepared in accordance with Section 506 of the Standard Specifications.

All material in the roadway deck shall conform to ASTM A572 Grade 50. Plate material for sidewalk orthotropic deck shall conform to ASTM A572 Grade 50. All shape material in the sidewalk orthotropic deck may be either ASTM A 572 Grade 50 or ASTM A36.

All hardware at access openings shall be stainless steel complying with the requirements of AISI Type 304 stainless steel.

Shop prime paint shall comply with the requirements specified for primer paint in the IDOT Special Provision for "Cleaning and Painting Existing Steel Structures."

Areas receiving field welds shall not be shop painted within 2 inches of the weld location. Painting shall proceed after welding inspection and approval according to spec section 506 unless the surface is subjected to a wearing coarse treatment.

Aluminum materials shall not be permitted to contact painted or plain steel. An approved isolator shall be used between all contact areas or as indicated in the Plans.

Construction Requirements. The fabrication and erection of the steel orthotropic deck shall conform to the requirements of Section 507 of the Standard Specifications, as indicated on the Plans, shop drawings as approved by the Engineer and as specified herein.

Fabrication:

1. All units shall be fabricated in accordance with approved shop drawings.
2. All shop welding shall be in accordance with requirements specified herein for welding.
3. All plates and reinforcement or anchorage steel shall be shop welded.

Welding:

1. All welding shall be in accordance with the applicable provisions of AASHTO/AWS D1.5-2008 as augmented by Article 507.04(s) of the Standard Specifications, and as further modified herein or on the Plans. Only certified welders as defined by AASHTO/AWS D1.5-2008 shall be used.
2. Field welds other than those indicated on the Plans are prohibited unless specifically authorized by the Engineer. All field welding shall be performed by qualified welders in an environment similar to indoor shop condition. The testing of the field welds shall conform to the requirements of the AASHTO/AWS D1.5-2008. Deck plate seam welds, rib to deck plate welds and CJP welds including splices shall be UT tested.
3. Welding shall be indicated on shop drawings using AWS symbols and showing length, size and spacing (if not continuous). Auxiliary views shall be shown to clarify all welding. Notes such as "1/4 weld", "weld" and "tack weld" will not be acceptable. Method of degrees of dressing and finishing exposed welds shall be clearly noted.
4. The responsibility for ensuring adequate workmanship and techniques will not be upon the Engineer. The Contractor shall provide competent supervision and inspection of all welding through his own certified welding inspectors.
5. The Contractor shall be responsible for the inspection and testing of all shop and field welds performed under the Contract as specified herein. Inspection and testing shall be at the Contractor's sole expense and all costs thereof shall be considered incidental to this Item. The results from all tests shall be made available to the Engineer as specified in Section 105 of the Special Conditions for Public Works Construction and as required by the Engineer.

Erection:

1. All erection shall be in accordance with Article 507.08 of the Standard Specifications, approved shop drawings and as specified herein.
2. Stability of deck panels shall be the responsibility of the erector during all erection phases. Panels shall be braced as required to assemble to final position as indicated in the Plans.
3. Unless otherwise indicated on the Plans or approved by the Engineer, all units of the steel orthotropic deck shall be supported on the steel bridge framing and shall be attached to shim plates which are directly fixed to all supports.

Shop Painting. All steel orthotropic deck not receiving wearing surface application shall be cleaned and shop painted on all surfaces in accordance with the requirements of Articles 509.03 and 509.04 of the Standard Specifications except the paint material shall comply with the requirements specified herein. Shop painting shall be excluded from areas as indicated under the material section of the special provision.

Method of Measurement. Steel orthotropic deck shall be measured for payment by the square foot in place.

Basis of Payment. The work under this Item will be paid for at the Contract unit price per square foot for **FURNISHING AND ERECTING STEEL ORTHOTROPIC BRIDGE DECK** and **FURNISHING AND ERECTING STEEL ORTHOTROPIC SIDEWALK**, as indicated on the Plans and as specified herein.

F-SHAPE ALUMINUM PARAPET

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and install the F-Shape Aluminum Parapet on the movable leaves and portion of the fixed spans of the bridge as shown on the Plans and as directed by the Engineer. All F-Shape Aluminum Parapet shall be complete with cap extrusions, curb extrusions, toe clips, posts, splice plates, bolts, nuts, washers, and curb supports, back cover plate, welding, field drilling and all other parts and all work to complete installation of the F-Shape Aluminum Parapet in accordance with the applicable requirements of Section 509 of the Standard Specifications, as specified herein and as shown on the plans.

Materials. **Aluminum alloy cap (top rail), toe clips and post assembly shall conform to ASTM B221 alloy 6061-T6, except for the face panels and the top cap which shall conform to alloy 6063-T6 and splice plates which shall conform to ASTM B 209 alloy 6061-T651.**

Construction Requirements. All bolts (AASHTO M164), washers and nuts in contact with aluminum, all steel posts, base plates and/or supporting angles shall be hot dip galvanized in accordance with ASHTO M 232 and ASTM A 153. All toe clips and all portions of aluminum components in contact with ungalvanized steel shall receive, as an insulator, one (1) layer of 30 lb, Asphalt Saturated Roofing Felt, conforming to Article 714.11-Type B, securely fastened to the aluminum surface with compatible adhesive. All supporting structural steel shall be pre-painted before installation of Aluminum Parapet. The top and bottom Aluminum Parapet shall follow the slope of roadway

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show spacing and size of posts, size and lengths of welds, size and location of fasteners, splices and trim, panel details, Aluminum Parapet Extrusion details, toe clip extrusion details, cap extrusion details, materials specifications and tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Basis of Payment. The work under this item shall be paid for at the Contract unit Price linear foot for **F-SHAPE ALUMINUM PARAPET**, for furnishing all labor, materials and equipment necessary to complete this work in accordance with the details shown on the Plans and as specified herein.

REMOVE AND REINSTALL EXISTING ALUMINUM PARAPET

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to safely perform all work including welding, field drilling and all other parts and all work to complete removal and reinstallation of the Aluminum Parapet in accordance with the applicable requirements of Section 509 of the Standard Specifications, as specified herein and as shown on the plans or as directed by the Engineer.

The Contractor shall carefully remove the existing Aluminum Median Parapet in the movable and fixed spans as shown on the plans. The Aluminum Median Parapet shall be removed, stored and re-installed in its original position in the fixed and movable spans.

All components not designated for reuse shall be removed from the site and disposed of in a legal manner.

Materials. Aluminum alloy toe clips shall conform to ASTM B221 alloy 6061-T6, except for splice plates which shall conform to ASTM B 209 alloy 6061-T651. All steel shapes and plates shall conform to the requirements of AASHTO M270 Grade 36 except posts shall conform to AASHTO M270 Grade 50 B.

Construction Requirements. All bolts (AASHTO M164), washers and nuts in contact with aluminum, all steel posts, base plates and/or supporting angles shall be hot dip galvanized in accordance with ASHTO M 232 and ASTM A 153. All toe clips and all portions of aluminum components in contact with ungalvanized steel shall receive, as an insulator, one (1) layer of 30 lb, Asphalt Saturated Roofing Felt, conforming to Article 714.11-Type B, securely fastened to the aluminum surface with compatible adhesive. All supporting structural steel shall be pre-painted before installation of Aluminum Parapet. The top and bottom Aluminum Parapet follow the slope of roadway

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show spacing and size of posts, size and lengths of welds, size and location of fasteners, splices and trim, panel details, toe clip extrusion details, materials specifications and tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Basis of Payment. The work under this item shall be paid for at the Contract unit Price linear foot for **REMOVE AND REINSTALL EXISTING ALUMINUM PARAPET**, for furnishing all labor, materials and equipment necessary to complete this work in accordance with the details shown on the Plans and as specified herein.

REMOVAL OF EXISTING CONCRETE DECK

Description. This Item of work shall consist of furnishing all the necessary labor, tools, equipment and materials to safely remove and satisfactorily dispose of the fixed roadway and sidewalk slabs of the Bridge as shown on the Plans or as directed by the Engineer. This work shall be done in accordance with the applicable requirements of Section 501 of the Standard Specification and as specified herein.

This Item shall include, but is not limited to the full depth removal of the concrete roadway and sidewalk on the fixed spans of the Bridge including the bituminous wearing surface, epoxy overlay, and as shown on the Plans or as directed by the Engineer.

Removal Requirements. All work shall be in accordance with the applicable requirements of Article 501 of the Standard Specifications.

The Contractor shall use only such methods and equipment for the deck removal appropriate with the special conditions set forth in the Plans concerning adjacent property requirements. The use of frost balls, drop hammers or explosive forces shall be prohibited. The Contractor shall take precautionary steps to keep dust and debris to a minimum and away from pedestrians, vehicles and adjacent properties.

All debris resulting from these operations shall be removed immediately from the site and legally disposed of in a manner satisfactory to the Engineer. Certificates of disposal shall be submitted to the Engineer for record.

The Contractor shall take any and all measures to protect and maintain the bridge operational systems located in the areas of demolition.

The Contractor shall include all protection as required to prevent any materials produced during bridge deck removal from falling into the river during such demolition operations.

The Contractor shall provide and install any necessary temporary shoring to support those elements of the structure indicated to remain in place while work progresses in adjacent locations. The Engineer shall review the design of and placement of said shoring prior to proceeding with demolition operations.

All existing items fastened to, or imbedded in the deck to be removed and reinstalled shall be stockpiled and secured in a location on the project site, as directed by the Engineer.

Method of Measurement. No separate measurement shall be made for work under this item.

Basis of Payment. The work under this Item shall be paid at the Contract price Lump Sum for **REMOVAL OF EXISTING CONCRETE DECK** which shall include the removal and disposal of all materials resulting thereof.

The cost of marking the flange locations shall be incidental to and included as part of the work under this Item.

All saw cutting required for the demarcation of demolition limits and/or the satisfactory removal of the deck shall be considered incidental to this item without additional compensation to the Contractor.

BRIDGE SIDEWALK REMOVAL

Description. This item shall consist of removing and legally disposing of the existing bridge sidewalk decks on the movable leaves of the Bascule Bridge as indicated on the Plans and as directed by the Engineer. All Work shall comply with the applicable requirements of Section 501 of the Standard Specifications, as specified herein.

The sidewalk deck removal shall include all concrete filled grating, timber sections, plates, access doors, hatches or other items attached or occurring within the sidewalk deck of the bridge.

All materials removed shall become the property of the Contractor and shall be disposed of by the Contractor off the site and in a lawful manner acceptable to the Engineer.

Removal Requirements. The Contractor shall submit, to the Engineer for review, his/her proposed method and equipment to be employed in the removal of the movable bridge decks.

Removal of the bridge decks shall be done in a manner and sequence consistent with the sequence of the rehabilitation of the Bridge.

When removing the existing sidewalk deck, care shall be taken as to not damage existing structural steel members, adjacent surfaces or materials or adjacent construction which are to remain. The Contractor shall be responsible for all expense and/or costs of repairing or replacing damaged steel members, surfaces, materials or construction caused during the removal operations. Repairs shall be done as directed by the Engineer and may include grinding, welding and/or member replacement depending upon location and severity of the damage.

The Contractor shall include all protection as required to prevent any materials produced during sidewalk deck removal from falling into the River or on the existing equipment below such demolition operations.

Method of Measurement. Bridge sidewalk removal will be measured for payment in place and area computed in square feet of sidewalk deck to be removed.

Basis of Payment. This Work will be paid for at the Contract unit Price per square foot for **BRIDGE SIDEWALK REMOVAL**, which price shall be payment in full for all labor, tools, equipment and incidentals and performing all work to complete the sidewalk deck removal as indicated on the Plans, as specified herein, and as directed by the Engineer.

TIMBER BUMPERS

Description. This item of Work shall consist of furnishing all the necessary labor, tools, equipment, and incidentals for safely furnishing, transporting, storing, and installing the TIMBER BUMPERS as shown on the Plans, specified herein or as directed by the Engineer. This shall include furnishing, treating, and installation of timber and bumper timber in counterweight pits; furnishing, fabricating, galvanizing, and installation of all hardware as shown on the Plans, specified herein or directed by the Engineer.

Materials. The timber shall be creosoted Dense Structural 65 Grade Southern Yellow Pine conforming to the "Grading Rules for Southern Pine Lumber of the Southern Pine Inspection Bureau."

The seasoning, preparation, and treatment of timber shall be in accordance with the American Wood Preservers Association (AWPA) Standard for Preservation Treatment by Pressure Processes for All Timber Products C 1-73, and as specified herein.

All timber shall be thoroughly air seasoned before treatment according to AWPA Standard M 1-72. Conditioning by oil or steam seasoning will not be permitted.

The preservative shall be creosote (AWPA P1/P13-91) or creosote coal tar solution (AWPA P2-58, Grade A) which shall conform to the requirements as set forth for each in the 1993 Manual of Recommended Practices of the AWPA. Treatment of timber shall be in accordance with AWPA Standard C2-93 and shall be treated to retain at least ten (10) pounds of preservative per cubic foot.

Handling. Timber shall be handled so as to avoid dropping, bruising, or breaking the outer fibers, or penetrating the surface with tools before or during driving. Sharp pointed tools shall not be used in handling the creosoted piles.

Framing. Framing of Fender System should be done as shown on the Plans.

Hardware. All hardware shall be galvanized by the hot dip process in accordance with ASTM A153. Galvanized hardware shall conform to ASTM A386. Bolts shall be of the diameter shown on the Plans and of the "Sealtite" type. Stainless steel shall be of ASTM A276, Type 304.

Method of Measurement. Measurement of TIMBER BUMPERS, as shown on the drawings, as specified in this Section and as accepted in the final work, shall be on linear foot basis. This measurement shall include creosote lumber galvanized hardware, stainless steel bolts, nuts and washers, and any miscellaneous or incidental materials necessary for completion of the work.

Basis of Payment. The work under this item will be paid for at the contract unit price of linear foot for **TIMBER BUMPERS**, as indicated on the Plans, specified herein or as directed by the Engineer.

CARBON FIBER REINFORCED POLYMER REPAIR

Description. This work consists of furnishing all materials, labor, equipment and supervision necessary for the installation of externally bonded CFRP reinforcement, field applied at the counterweigh pit wall supporting the trunnion columns as shown in the plans and as directed by the Engineer. The work includes:

1. The temporary or permanent utility relocation in the CFRP repair area must be coordinated and performed by the Contractor.
2. The concrete substrate must be repaired, if necessary, all protrusions must be removed. All the concrete repair work, and removal of protrusions must be done by the Contractor.
3. Application of Putty materials on certain areas that need filling to have a uniform surface area.
4. Surface preparation, sandblasting, and cleaning of all surface areas to receive the Carbon Fiber Reinforcement Laminates.
5. Application of the Primer materials on all surface areas to receive the Carbon Fiber Reinforcement Laminates.
6. Application of the Saturant epoxy materials.
7. Application of bidirectional Carbon Fiber Reinforcement Laminates centered and oriented in the transverse and longitudinal directions over repaired area as described in the special provisions of section 550 and indicated in the plans.
8. Application of final paint Topcoat protection.
9. Application of fire retardant by Albi or equivalent.

Materials. Furnish only new materials. Provide bidirectional high-strength carbon fiber fabric. The CFRP composite system must be a proprietary system consisting of all associated fiber reinforcement and polymer adhesives/resins. CFRP composites consisting of fiber reinforcement and polymers provided by more than one manufacturer are not allowed. Properties of the carbon fibers in the CFRP must meet or exceed the following requirements:

Table 1 CFRP Carbon Fiber Property Requirements

Property	Specification Requirement
Tensile Strength*	500 ksi
Tensile Modulus*	33,400 ksi
Ultimate Elongation*	1.50%

* Verified by ASTM D3039 test procedure

Provide flexible, waterproofing, non-vapor-barrier protective top coating compatible with the CFRP per manufacturer's recommendations to protect the CFRP from ultraviolet radiation and mild abrasion. Match color and texture of protective top coating to adjacent concrete. Complete CFRP systems, including CFRP and top coating, that are pre-approved under this specification are listed below:

Table 2 Approved CFRP Systems

Product Name	Producer
SikaWrap Hex 113C Bi-Directional Carbon	Sika Corporation
Wabo Mbrace CF130 Bi-Directional CFRP	Watson Boman Acme Corporation
Or Equal System Bi-Directional CFRP	

Substitutions for pre-approved systems that provide equivalent strengthening results are subject to approval by the Engineer.

The epoxy must be supplied by the manufacturer as a part of the system designed for use with the selected fabric. Substitutions allowed, if the Manufacturer/Supplier can supply an engineer approved equal materials in terms of strength and durability. The Engineer must approve the product. Polyester resin will not be allowed as a substitute for epoxy resin.

Submittals. The Contractor must submit the following information at least two weeks prior to installation:

Manufacturer's product data sheets indicating physical, mechanical and chemical characteristics of all materials used in the CFRP system. Information must include manufacturer's name and product number for all materials. Information must include dry fabric thickness and minimum effective composite thickness per layer. For epoxy resins it shall include mix ratio by weight and volume, pot life, shelf life, resin gel time at proposed cure temperatures, mixing and application instructions and temperature ranges, and storage requirements. For paint it must include mixing instructions, application method, application temperature ranges and storage requirements.

Manufacturer's tensile properties of the composite material as determined by tensile testing in accordance with ASTM D 3039. Ultimate tensile strength and rupture strain values must be determined by subtracting three standard deviations from the average values of twenty or more tensile tests.

Manufacturer's installation instructions, maintenance instructions and general recommendations regarding each material to be used. Installation instructions must include curing procedures for the composite system if required.
 Manufacturer's Material Safety Data Sheets (MSDS) for all materials to be used.

The material supplier's name, address, and phone number, and the name, telephone and fax number of a contact person employed by that company.

Complete step-by-step procedures and specifications for repairs of any defects. Procedure shall specify that if a defective composite area is greater than 50 square inches, the defective area shall be repaired by removing and reapplying.

Complete step-by-step procedures for repairs of any future defects or damage. Including recommendations for any periodic maintenance or inspections, if required.

Also include recommended materials and procedures for future repainting including surface preparation.

GENERAL REQUIREMENTS:

DESIGN

The details and number of layers of Carbon Fiber Reinforcement Laminates that are needed to restore and strengthen the capacity of the existing members are as shown in the plans. No changes will be allowed without the approval of the Engineer.

DELIVERY, STORAGE AND HANDLING

The products must be delivered and stored in original, unopened containers. Containers must be clearly marked with legible and intact labels listing the Manufacturer's name, brand name, product identification and batch number.

Storage of fiber reinforcement and epoxies must be in areas protected from dust, moisture, and chemical exposure. Epoxies must be stored in areas with an ambient temperature between 50°F and 75°F and away from direct sunlight, flame sources or other hazards. Epoxy resins must be stored separately from hardeners.

The fiber reinforcement must not be handled roughly. For specific hazards of resin components consult the Manufacturers MSDS.

CONSTRUCTION DETAILS:

Surface Preparation:

All surfaces must be repaired by the contractor prior to installation of CFRP.

Surfaces to receive CFRP laminate must be free from fins, sharp edges, and protrusions that will cause voids or depressions behind or within the installed FRP laminate or that, in the opinion of the Engineer, will damage the fibers.

Where shown on the plans, corners must be rounded to at least 3/4" radius and smoothed to a surface finish in conformance with these specifications prior to the application of fibers.

The surfaces to receive the composite wrap must be smooth and free of voids or undulations that would prevent full contact between the concrete and the wrap.

The contact surfaces must be clean, sandblasted or pressure washed, free from oil, dirt, salt, etc., completely dry at the time of application of the composite. Power sanders or other approved abrasive means must be used to achieve a smooth even surface of uniform texture and appearance. Allow newly repaired or patched surfaces that have set, and cured a minimum of 72 hours to reach a minimum of 3,000 psi compressive strength prior to installation of any CFRP components.

Application

1. The ambient temperature and the temperature of the epoxy resin components must be between 55°F and 95°F at the time of mixing. Care must be taken to ensure that the surface temperature of the concrete that the CFRP system is being applied to is within the appropriate range for the epoxy resins. The composite must be applied when the relative humidity is less than 85% and the surface temperature is more than 5°F above the dew point. Applications must begin within one hour after the batch has been mixed.
2. The components of the epoxy resin must be mixed with a mechanical mixer for a minimum of 5 minutes and applied uniformly to the fiber at a rate that insures complete saturation of the fabric.
3. A primer of epoxy must be applied to the surface to be wrapped.
4. The CFRP composite must be applied to the prepared surface by wrapping using methods that produce a uniform force that is distributed across the entire width of the fabric. The primary fibers of the fabric must not deviate from a vertical line more than ½ inch per foot, and the transverse fibers must be perpendicular to the primary. Entrapped air must be released or rolled over before the epoxy sets.
5. An overlap length of 6 inches or that recommended by the CFRP manufacturer is required for splices in the fiber direction of individual layers.
6. After the last layer of fabric is installed a final layer of epoxy must be applied with care to insure coating of all edges and seams.
7. The individual supervising the installation of the fiber wrap must be the same individual noted in the approved *Information and Installation Manual*. This individual must be on site full time when fiber wrap is being installed. This individual must not be removed or reassigned from the project without written permission of the Engineer.
8. The Contractor must maintain a *Wrapping Log*. The *Wrapping Log* must be available for review by the Engineer at all times, and upon completion of all wrapping the Engineer must be given a copy. The log must provide a material traceability and records for the wrapping of each beam. As a minimum the *Wrapping Log* must contain:
 - a. Project name and contract number.
 - b. Material information including product description, date of manufacturer and lot or batch numbers and location that products are installed.
 - c. Daily fabrication, inspection, and verification data for the days of construction. Include as a minimum the locations, composite thickness, ambient temperature and humidity readings at the beginning, middle and end of each shift (or at the beginning and end of installation), documentation of any required curing process, thickness of any paint or protective coating applied, location of any damaged areas that are repaired.

Coating System Application:

Exposed surfaces of CFRP laminates must be cleaned and painted in accordance with this specification and the FRP manufacturer's recommendations.

A final coating is required to protect the fibers from the elements, specifically UV radiation and to give the final aesthetic effect.

After 48 hours from final application of epoxy coat, when the material is completely polymerized, the surfaces to be cleaned and painted must be lightly roughened by uniform abrasive blasting using an abrasive no larger than 80 mesh. The air pressure at the nozzle used for abrasive blasting must not exceed 80 psi. The abrasive must be of appropriate hardness to roughen the surface without damaging the fiber portion of the CFRP laminate. The fiber portion of the CFRP laminate must not be exposed by the abrasive blasting operation. Abrasive blasting will not be required if the first coat of paint is applied within 48 hours after mixing the components for the final resin coating. All cleaned and roughened surfaces must be dry before painting. The area to be painted must receive a total dry film thickness of not less than 4 mils.

Fire Considerations:

Fire resistance of FRP systems must be improved by adding fire retardants to the resin or by coating on the surface of the FRP.

Material: Fire retardant coating must be Albi Cote FRL as manufactured by Albi Manufacturing, Division of StanChem, Inc. or approved equal. Fire retardant coating must be tested and classified by Underwriters' Laboratories, Inc. offering evidence of Class A rating. Material must be applied at the listed rate of coverage to conform to the UL classification and to the intent of this specification.

Application: Apply Albi Cote FRL in one or multiple coats to achieve specific coverage rate, assuring compliance with intent of specifications. Albi Cote FRL can be applied by conventional air, airless spray, brush or roller. For spraying consistency, thin with water not to exceed one half pint per gallon.

TESTING, INSPECTION AND REPAIR OF DEFECTIVE WORK

Field Inspection:

The Engineer will inspect the cured composite system for defects consisting of external abrasions or blemishes, delaminations, voids, external cracks, chips, cuts, loose fibers, foreign inclusions, depressible raised areas or fabric wrinkles. The following repair criteria apply:

1. All defects greater than 1" long or a defective area greater than one square inch must be repaired in accordance with the approved *Information and Installation Manual*.
2. If the number of defects of any size within an individual repair exceeds 10, the repair must either be repaired or replaced as directed by the Engineer.

Testing:

Prior to the installation process, the Contractor must furnish to the Engineer one 12" x 12" sample of the cured composite system for each separate repair. The Engineer may randomly test the samples at his/her discretion to verify ultimate tensile strength, percent elongation, etc. values as provided by the manufacturer. The Engineer will precondition the samples at 140°F for 48 hours. Two ¾" x 9" coupons will be cut from each sample and tested in accordance with ASTM D3039

The Contractor shall perform at least 2 direct pull-off tests (after the initial resin has cured at least 24 hours) on CFRP 12"x12" test samples prepared at locations of similar substrate near the CFRP installation area. Prepare the test samples using identical application procedures at the same time that the project CFRP is installed. The tests will be done in accordance with ASTM D4541 to verify the tensile bond between the concrete and the CFRP system.

Method of Measurement. CFRP repair will be measured and paid for at the contract unit price per square foot per layer, which payment shall constitute full compensation for cleaning, furnishing all material, labor, tools, equipment, and incidentals necessary to complete the work specified. Work to repair the surface prior to wrapping will be paid for under separate pay items.

Basis of Payment. This Work will be paid for at the Contract Unit Price per square foot for **CARBON FIBER REINFORCED POLYMER REPAIR** which will be payment in full for performing the Work described herein.

COUNTERWEIGHT PIT CLEANING

Description. This item of Work shall consist of furnishing all the necessary labor, tools, equipment and materials required to remove and dispose of all debris in the counterweight pits, including all material on the bridge seats and on the river piers as well. The Contractor will be responsible for dewatering the pits as required to complete this work.

All debris resulting from this operation shall be removed immediately from the site and disposed of in a manner satisfactory to the Engineer. All removed material shall be considered surplus and shall be disposed of by the Contractor at his/her expense. Contaminated water that is to be removed from the pits shall not be pumped to the river, but shall be disposed of in an environmentally acceptable manner. The manner and location of disposal shall be determined by the Contractor and shall be subject to the approval of the Engineer. The Contractor shall furnish satisfactory evidence that he/she use the proper authority for the disposal.

Basis of Payment. The work under this item will be paid for at the contract unit price of each **COUNTERWEIGHT PIT CLEANING**, as indicated on the Plans, specified herein or as directed by the Engineer.

ABRASION RESISTANT POLYURATHANE WEARING SURFACE

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and surface the orthotropic deck and orthotropic sidewalks in the movable spans with an abrasion and skid resistant wearing surface as shown on the Plans and as directed by the Engineer.

Materials. The abrasion resistant, skid resistant wearing surface system shall consist of a solvent-based aluminum pigmented polyurethane primer that is resistant to cathodic disbonding with a minimum of 1700 psi adhesion to steel, a polyurethane resin with a minimum tensile strength of 1450 psi, a minimum of 1700 psi adhesion to steel, a minimum of 15% elongation, and a graded Aluminum Oxide containing a minimum of 60% alumina with aggregate size of 1/8" to 7/32" for the deck and 1/16" to 1/8" for the sidewalk. The wearing system shall be applied as per manufacturer's recommendation.

The steel substrate shall be blast cleaned to an SSPC SP10 standard.

The abrasion resistant, skid resistant wearing surface shall be Bimagrip LS for the Roadway deck and Bimagrip HD for the sidewalks as manufactured by RS Clare, or an approved equal.

The wearing surface shall be applied to the deck and sidewalk panels in the shop except for sections as shown on the plans.

The bidders are advised that the equilibrium of the completed bridge has been based on a wearing surface system with 3.0 pounds per square foot for the deck and 1.8 pounds per foot for the sidewalk, and that these weights, with a maximum variation of 1/4 pound, plus or minus, will be required.

All delivery, storage and handling concrete components shall comply with the manufacturer's instructions to prevent components from being damaged.

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The submittals shall include shop drawings and product data for the wearing surface system, including product data illustrating the design parameters

Field Quality Control The entire system shall be measured, mixed, and applied by an Applicator that is approved by the membrane system manufacturer. A manufacturer's technical representative shall be present during the entire installation of the system both at on-site and off-site locations. The manufacturer's technical representative and the approved applicator shall perform testing and monitoring during the application. All information shall be recorded on a daily basis and submitted to the engineer within 3 days of work performed including proper material storage, material batch numbers, surface preparation acceptance, adhesion testing in accordance with ASTM D4541 and a minimum of 3 tests per every 5,000SF, and surface, air and dew point testing.

Coverage rates for all coats shall be monitored by checking quantity of material used against the area covered. All areas shall be clearly marked prior to the application of each material placed to verify quantities used against square footage. All drums and pails of materials shall be consecutively numbered before the start of project to help verify usage rates during application.

Warranty: The Contractor shall warrant all work to be performed and all materials to be furnished against any defects in material or workmanship for a period of 5-years from the date of final acceptance of the work, unless a longer warranty is specified. Should defects develop

within the warranty period due to faults in materials or workmanship or both, the Contractor shall make repairs and do necessary work to correct defects so that the work fully complies with the contract to the satisfaction of IDOT.

Method of Measurement. The Abrasion Polyurethane wearing surface Resistant Steel shall be measured for payment on the basis of square foot in place.

Basis of Payment. The Work under this item will be paid for at the Contract Unit Price per square foot for **ABRASION RESISTANT POLYURETHANE BRIDGE WEARING SURFACE** and **ABRASION RESISTANT POLYURETHANE SIDEWALK WEARING SURFACE**, as indicated on the Plans and as specified herein.

RIVET REMOVAL AND REPLACEMENT

Description. This item consists of furnishing labor, tools, equipment, incidentals and all materials required to remove deteriorated rivets and/or bolts with replacement of high strength bolts. Existing rivets and/or bolts shall be removed without causing damage to members that remain in place. Any damage to said members caused by the Contractor's operations shall be replaced and/or repaired, as directed by the Engineer, at the Contractor's expense.

The use of oxyacetylene or oxy-MAPP gas cutting is not permitted, although arc gouging is permissible to cut out the central core of rivets if no cutting of the hole ID occurs. The rivet shall then be forced out by mechanical means. If cutting of the hole ID does occur, the hole shall be redrilled to the next larger-sized bolt which eliminates any cuts caused by arc gouging.

The existing rivets and/or bolts to be removed and replaced with high strength bolts shall be designated in the field by the Engineer at the time work is being performed. The Contractor is advised that work as covered under this item may extend to any and all members in the Structure. Removal of existing rivets and/or bolts and replacement with high strength bolts shall be accomplished one at a time, except as approved by the Engineer.

Work under this item does not include the removal and replacement of connectors required to perform other work items detailed in this work. New high strength bolts shall be the same nominal diameter as the connector removed. High strength bolts shall be ASTM-A325 unless noted and shall conform to Section 505 of the Standard Specifications. Contact surfaces between the existing steel adjacent to bolt heads, nuts or washers shall be free of all mill scale, paint, dirt, burrs, and other defects that would prevent solid seating of all parts.

Upon completion of the connector replacement, the new bolts shall be cleaned and painted with one coat of primer as specified under the item "CLEANING AND PAINTING STEEL BRIDGE."

Basis of Payment. This item shall be paid for at the Contract Unit Price each for **RIVET REMOVAL AND REPLACEMENT**. Price shall be payment in full for all materials, labor, tools, removing and replacing connectors as designated, cleaning and painting including all incidental work necessary to complete the work as shown on the Plans or as specified herein and as directed by the Engineer.

BRIDGE DECKING

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and install factory fabricated and finished 4-1/4" Interlock Full Depth steel grid decking at the rear arm of the inside trusses as shown on the Plans and as directed by the Engineer.

Materials. The grid reinforced bridge decking shall consist of the following elements:

1. Main Bars shall be 4-1/4" deep, 5.0#/LF spaced 6" c/c.
2. Cross Bars shall be 1-1/2" x 1/4" spaced 4" c/c.
3. Form Pans shall be 20 gauge sheet metal shop installed. Form Pans at panel splices shall be provided and shipped loose for field installation.
4. End Trim Bars shall be shop attached as shown on the contract plans.
5. Panels shall be galvanized to meet ASTM A-123.
6. Concrete: Shall be standard class with 3/8" maximum aggregate size.

Bridge decking shall be as manufactured by LB Foster, or an approved equal.

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show spacing and size of all longitudinal and transverse members of the grid units, size and lengths of welds, size and location of fasteners, splices and trim, panel details, connection location and details, materials specifications and tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Erection: Install the grid bridge decking in accordance with the project drawings, specifications, approved shop drawings, and manufacturer's installation standards.

Method of Measurement. Bridge decking shall be measured for payment on the basis of square feet in place, including trim bars and edge bars and all connectors.

Basis of Payment. The Work under this item will be paid for at the Contract Unit Price per square foot for **BRIDGE DECKING OVER REAR ARM, 4-1/4"**.

SIDEWALK FLOORING

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and install factory fabricated and finished sidewalk flooring over the rear arm of the outside trusses as shown on the Plans and as directed by the Engineer.

Materials. The grating shall consist of panels not to exceed 4'-0"x10'-0", fabricated of ASTM A709, Grade 36 Steel. The flooring shall be surfaced with a steel Mebac. Uniformly dispersed aluminum oxide grit particles shall be encapsulated in a metal matrix and metal bonded to the 1/4" sidewalk plate by an electric-arc spray process utilizing high purity ASTM AA709, Grade 36 steel. The finished surface shall have minimum bond strength of 656 pounds per square inches. Grit area shall be uniform and void of areas of minimal or no grit to ensure anti-skid performance. The finished product shall be hot dipped galvanized in accordance with ASTM A123.

The sidewalk shall be fabricated with 1 ½ inch by 3/16 inch stiffeners and welded to the plate in accordance with manufacturer's standards.

The sidewalk flooring weight shall not exceed 14.5 pounds per square foot. The minimum section modulus for a one-foot width of flooring shall be 1.871 in³/ft (Top) and 0.317 in³/ft (Bottom).

Flooring shall be banded on all sides with trim bars.

Sidewalk flooring shall be as manufactured by LB Foster, or an approved equal.

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show spacing and size of all longitudinal and transverse members of the grid units, size and lengths of welds, size and location of fasteners, splices and trim, panel details, connection location and details, materials specifications and tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Erection: Unless otherwise indicated on the plans or approved by the Engineer, all units of the sidewalk flooring shall supported on steel bridge framing and shall be welded to all supports.
All

Method of Measurement. Sidewalk flooring shall be measured for payment on the basis of square feet in place, including trim bars and edge bars and all connectors.

Basis of Payment. The Work under this item will be paid for at the Contract Unit Price per square foot for **SIDEWALK FLOORING OVER REAR ARM, 2"**.

CONCRETE STAIRS REPAIRS

Description: This work shall consist of removal, when required, the removal and disposal of all loose and deteriorated concrete from concrete stairs in the bridge houses and the replacement with new concrete to the original shape as shown on the plans and as directed by the engineer.

Materials:

(a) Concrete Repair Materials:

1. Portland Cement: ASTM C 150, Type I
 2. Normal-Weight Aggregates: ASTM C 33, Class 3S
 - a. Maximum Coarse-Aggregate Size: ¾ inches.
 - b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - c. Water: ASTM C94, potable.
- (b) Epoxy Coated reinforcing steel: ASTM A 615, Grade 60, ASTM A 706 deformed bars.
(c) Anchor Adhesive: Hilti HFX or approved equal.
(d) Bonding Agent: Basis of Design; Euclid EUCO WELD. Equivalent polyvinyl acetate base material by Tamms, L&M Construction Chemicals, or Burke are acceptable

Construction:

- (a) Disposal: The Contractor shall remove the existing damaged concrete materials and dispose of them properly.
- (b) Safety: The Contractor shall follow all IDOT safety work rules and OSHA requirements.
- (c) Concrete repairs shall be as follows:
 - Remove damaged concrete or loose concrete.
 - Drill holes in the sound concrete for the reinforcing.
 - Remove dust or dirt from the sound concrete surface.
 - Anchor reinforcing into hole.
 - Apply bonding agent per the manufacturer's instructions.
 - Form repair, and fill with concrete.
 - Finish concrete to match adjacent surfaces.
- (d) All delivery, storage and handling concrete components shall comply with the manufacturer's instructions to prevent components from being damaged.
- (e) Warranty: The Contractor shall provide a 1-year warranty according to the Standard Documents for Construction.

Basis of Payment: The concrete repair work shall be paid for as part of the contract Lump Sum price **CONCRETE STAIRS REPAIRS**.

STONE MASONRY REPAIRS AND REPLACEMENT

Description: This work shall consist of repairs to deteriorated exterior stone panels as shown on the plans and as specified herein. Restoration Contractor shall be responsible for designing stone anchorage details per requirements in ASCE -07 and minimum seismic acceleration of 0.20 g. This Work shall include removal of vegetation, cleaning, repair, resetting, replacing and tuckpointing of existing stone panels.

Materials:

- (a) Replacement Stone: ASTM C 568, Indiana Limestone to match existing stone wall panels in color, grain, veining, grade, finish, and density
- (b) Mortar Materials:
 - 1. Portland Cement: ASTM C 150, Type I.
 - 2. Hydrated Lime: ASTM C 270 Type S.
 - 3. Fine Aggregates: ASTM C 144, 100 percent passing a No. 16 sieve.
 - 4. Water: ASTM C94, potable.
- (c) Stone Anchors: Stainless steel wire, ASTM A 580 Type 304 or stainless steel sheet ASTM A 240, Type 304.
- (d) Anchor Adhesive: Hilti HFX or approved equal.
- (e) Non-acidic Stone Cleaners: Basis of Design; Prosoco Sure-Klean products. Equivalent cleaning material by Dominion Restoration Products, Drummond Chemicals, or Price Research Ltd. are acceptable.
- (f) Sealant: ASTM C270 Single component, nonsag urethane, color to match stone.
- (g) Joint Sealant Backing: ASTM C1330, Type C, Cylindrical closed cell foam.

Construction:

- (a) Disposal: The Contractor shall remove damaged stone materials and dispose of them properly.

- (b) Safety: The Contractor shall follow all IDOT safety work rules and OSHA requirements.
- (c) Contractor shall inspect existing stone panels and anchorage, and design repairs and anchorage for new replacement stone panels.
- (d) Stone Masonry repairs shall be as indicated on the drawings and follows:
- Remove vegetation from all stone panels.
 - Clean all limestone panels.
 - Rake sealant and mortar from stone joints.
 - Repair damaged limestone panels as indicated on the drawings.
 - Replace limestone panels as indicated on the drawings.
 - Reset limestone panels as indicated on the drawings.
 - Replace limestone panel anchorage as required.
- (e) All delivery, storage and handling of stone masonry restoration components shall comply with the manufacturer's instructions to prevent components from being damaged.
- (f) Submittals:
- Stone Restoration Specialist Firm shall provide a list of previous projects completed over a period of not less than five years.
 - Actual samples of replacement stone material at least 12 inches square.
 - Restoration plan including proposed cleaners, anchors, and other materials.
 - Product data for proposed cleaning chemicals.
- (g) Protection:
- Protect persons, vehicles, and adjacent structure from overspray of cleaning chemicals.
 - Collect removed mortar and sealant and dispose of legally off site.
 - Do not apply chemical in adverse wind conditions.
 - Remove mortar and sealant smears on stone panels.
- (h) Stone Removal and Replacement:
1. At locations indicated, remove stone that has deteriorated or is damaged beyond repair or is to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.
 2. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
 3. Notify Engineer of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.
 4. Remove in an undamaged condition as many whole stone units as possible.
 5. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
 6. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.

7. Store stone for reuse. Store off ground, on skids, and protected from weather.
8. Deliver cleaned stone not required for reuse to Owner unless otherwise indicated.
9. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
10. Retain option in first paragraph below if salvaged stone is available.
11. Replace removed damaged stone with other removed stone and salvaged stone in good quality, where possible, or with new stone matching existing stone, including size. Do not use broken units unless they can be cut to usable size.
12. Retain first paragraph below for stone having bedding planes, usually sedimentary stone such as limestone and sandstone. Retain option if there are arches; revise if bedding planes are used ornamentally or with fleuri cut.
13. Do not allow face bedding of stone. Before setting, inspect to verify that each stone has been cut so that, when it is set in final position, natural bedding planes are essentially horizontal.
14. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.
15. Maintain joint width for replacement stone to match existing joints.
16. Retain subparagraph below especially for narrow joints and where multiple courses are laid.
17. Use setting buttons or shims to set stone accurately spaced with uniform joints.
18. Set replacement stone with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type required.
19. Retain subparagraph above or first subparagraph below. Coordinate with mortar mixes in Part 2.
20. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
21. Rake out setting mortar to facilitate sealant joints.
22. Tool exposed sealant joints.

(i) Warranty: The Contractor shall provide a 1-year warranty according to the Standard Documents for Construction.

Basis of Payment: The stone masonry repairs and replacement work shall be paid for as part of the contract Lump Sum price for **STONE MASONRY REPAIRS AND REPLACEMENT**.

METAL FABRICATIONS

Description: This work shall consist of repairs and replacement of metal ladders, metal handrails and metal guardrails, metal platforms, and metal stairs including all appurtenant and collateral work as shown on the Plans, called for in the Specifications or as directed by the Engineer. The work shall also include the removal and replacement of deteriorated metal platform support members (members with more than 20% section or has rusted holes) as directed by the Engineer; all access platform in the machinery rooms, adjacent to the trunnion girders and center locks; and the removal and legally disposing of the members called for replacement.

Materials:

- (a) Steel Shapes and Plates: ASTM A36.
- (b) Steel Pipe Sections: ASTM A53.
- (c) Steel Tubing: ASTM A500 Grade B.
- (d) Bolted Connections: ASTM A325N
- (e) Shop Primer: MPI #79, modified alkyd primer.

Construction:

- (a) General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
 - 3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
 - 4. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
 - 5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 - 6. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - 7. Shop prime all metal fabrications with Masters Painters Institute, #76 Q.D. Alkyd Metal Primer.
 - a. Acceptable Manufacturers:
 - 1. Benjamin Moore.
 - 2. ICI Paints.
 - 3. PPG.
 - 4. Sherwin Williams.
 - 6. Paint: Provide two field applied coats of Master Painters Institute, #81 Q.D. Semi-gloss enamel on factory primed metal fabrications.
 - a. Acceptable Manufacturers:
 - 1. Benjamin Moore.
 - 2. ICI Paints.
 - 3. PPG.
 - 4. Sherwin Williams.

(b) Metal Ladders:

1. Comply with ANSI A14.3 and OSHA Subpart D Section 1910.27.
2. Space side rails 18 inches apart.
3. Steel Ladder Construction: Flat bar side rails, with 3/4-inch-diameter steel bar rungs fitted in centerline of side rails, plug-welded, and ground smooth on outer rail faces.
4. Ladders shall be painted safety yellow.

(c) Metal Handrails and Guardrails:

1. Provide handrails and guardrails as indicated on the drawings.
2. Guards shall meet OSHA Subpart D Section 1910.23.
3. Guard rails shall be at least 42 inches tall, consisting of a top rail, mid rail, and toe kick.
4. Handrails shall be securely mounted to walls or guardrails.
5. Guardrails and handrails shall be painted safety yellow.

(d) Metal Platforms and Grating:

1. All platforms in the machinery rooms, at the trunnion girders, and center locks as specified herein and as indicated on the drawings.
2. Platforms shall be constructed of steel grating.
3. Platforms shall be welded to support framing.
4. Steel Platforms shall be painted safety yellow.

(e) Metal Stairs:

1. Steel stair is detailed and specified on the drawings.

(f) Safety: The Contractor shall follow all IDOT safety work rules and OSHA requirements.

(g) All delivery, storage and handling of components shall comply with the manufacturer's instructions to prevent components from being damaged.

(h) Shop Drawings: Include plans, sections, and details of metal fabrications and their connections.

(i) Warranty: The Contractor shall provide a 1-year warranty according to the Standard Documents for Construction.

Basis of Payment: The work will be paid for at the contract unit price per each for **METAL LADDERS, METAL SHIP LADDERS**; the contract unit price per linear foot for **METAL HANDRAIL AND METAL GUARDRAIL**; the contract unit price per lump sum for **METAL GRATING** and **METAL STAIRS**.

WINDOW REMOVAL AND REPLACEMENT

Description: This work shall consist of removing and replacing all existing windows at the two Bascule Bridge Operator's Houses as shown on the plans and as specified herein. The drawings of the bridge house and its windows are for reference only, the contractor shall field measure all windows to ensure a proper fit.

Materials: Replacement window unit specifications are as follows:

- (a) Provide 2 inch Heavy Commercial Projected window, AAMA rating AP-AW65.
- (b) Design window units and supports to withstand 85 mph winds with deflection limited to 1/175 glass edge length
- (c) Provide thermally broken aluminum frames.
- (d) Provide 1 inch (1/4-1/2-1/4) insulating glazing units with high performance "low-e" glass and filled with argon gas, Min. R Value of 3.
- (e) Provide 1/4 inch thick heat strengthened, clear glass.
- (f) Provide operable vents as indicated on the drawings.
- (g) Provide locking cam handles, access controlled locks and 4-bar stainless steel hinges.
- (h) Finish: Class I clear anodic coating complying with AAMA 611.
- (i) Provide all anchorage and trim required for a complete weather tight installation.
- (j) Provide silicone sealants as part of the window installation.
- (k) Contractor shall provide two year written warranty against all defects in labor and materials.
- (l) Contractor shall provide ten year written warranty against all defects in glazing materials.
- (m) Contractor shall provide ten year written warranty against all defects in metal finish.

Manufacturers: Basis of Design Window is EFCO Series 2700 2" Commercial Projected Window.

Alternate Manufacturers:

- (a) All Seasons Windows & Doors; All Seasons Commercial Division, Inc.
- (b) Custom Window Company.
- (c) Graham Architectural Products Corp.
- (d) Kawneer; an Alcoa Company.
- (e) TRACO.
- (f) Wausau Window and Wall Systems.
- (g) Winco Window Company.
- (h) YKK AP America Inc.

Construction:

- (a) Remove all of the existing windows at the two Bascule Bridge Operator's Houses. Carefully remove and dispose of the existing windows.
- (b) Protect interiors from weather at all times during the construction process.
- (c) Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- (d) Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- (e) Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- (f) Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

- (g) Adjust operating ventilators, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.
- (h) Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- (i) Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- (j) Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.

Field Testing:

- (a) Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- (b) Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- (c) Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A to determine compliance with AAMA/WDMA 101/I.S.2/NAFS
 - 2. Testing Extent: All windows. Windows shall be tested immediately after installation.
 - 3. Test Reports: Shall be prepared according to AAMA 502.
- (d) Remove and replace non-complying aluminum window and retest as specified above.
- (e) Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Basis of Payment: The removal and replacement of the windows will be paid for at the contract unit price per Lump sum for **WINDOWS**.

ROOF REMOVAL AND REPLACEMENT

Description: This work shall consist of removing the existing built-up roof system at both Bridge Operators Houses and replacing them with an adhered TPO (Thermo Plastic Polyolefin) membrane roofing system including, replacement roof drains, and TPO flashing system with metal fascia trim and, as shown on the plans and as specified herein.

Materials:

- (a) The Contractor shall furnish and install a new TPO roofing system including but not limited to: substructure repairs if required; roof insulation; replacement roof drains; roof membrane; heat welded seams; TPO flashing and trim; perimeter fascia; sealants; downspouts.

The Manufacturer of the roofing system has the primary responsibility for the system. Roofing system shall conform to the requirements of the International Building Code. The following is list of the minimum specified requirements of the roof.

- Air Infiltration: No air leakage when tested in accord with ASTM E283 at a pressure differential of 1.57 psf.
- Water Penetration: No water penetration when tested in accord with ASTM E331.
- Wind Uplifts: Comply with Underwriter's Laboratories, U.L. Class 90.

(b) For the entire roofing system, use materials either manufactured by or approved by only one of the specified manufacturers.

A Thermoplastic Polyolefin roofing membrane with polyester reinforcement as manufactured by:

- Carlisle Syn Tec Inc.
- Firestone Building Products Co.
- GAF Materials Corp.
- Stevens Roofing Systems.
- Versico Inc.

(c) Roofing Insulation: The roofing insulation shall be Rigid Insulation Board that meets the following requirements:

(1) Rigid Insulation Board:

- (i) Polyisocyanurate conforming to ASTM C1289 with square edges and a perforated black glass reinforced mat laminated to both faces.
- (ii) Two inch thickness.

(d) Metal Fascia: Provide SPRI ES-1 tested assembly consisting of an extruded aluminum anchor bar and a Fluoropolymer painted steel fascia cover. Provide prefabricated corners.

(e) Miscellaneous Materials:

(1) Fasteners: All fasteners shall be approved by the manufacturer.

(2) Sealants: As required or recommended by the manufacturer.

(3) Flexible EPDM Flashing and EPDM Pipe Flashings: As recommended by the roofing manufacturer.

(4) Downspouts: Interior existing downspouts are to be capped over and a new bi-functional roof drain (Froet interior downspouts are to be installed in their place adjacent to the existing inlets. Install a minimum of 4" diameter downspout to be made of no-hub cast iron.

(5) Copper flashings: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.

Construction:

(a) Disposal: The Contractor shall remove the existing roof construction materials and dispose of them properly. Care shall be taken so as not to disturb roof edge details indicated to remain.

No materials shall be allowed in the navigable waterway as per United States Coast Guard Regulations.

(b) Safety: The Contractor shall follow all IDOT safety work rules and OSHA requirements.

(c) Roof Installation Contractor:

The qualifications of the Roof Installation Contractor shall include:

- Be approved or franchised by the roofing manufacturer.
- Comply with the Illinois Roofing Industry Licensing Act.
- Use an adequate number of thoroughly trained and experienced workmen who are familiar with the specified requirements of this section.

The Roofing Installation Contractor shall take measurements of the structure prior to fabrication of components and shall submit the following:

- Within 30 days of receiving Notice of Award, the manufacturer's endorsement of the installing firm.
- Shop drawings to the manufacturer for review.
- Only manufacturer reviewed drawing are to be submitted to the IDOT Engineer.
- Drawings shall include: membrane layout; all flashing, closures, and trim; roof edges; curbs and other penetrations; and gutters and downspouts.

The Roofing Installation Contractor shall provide:

- Sample of roof membrane.
- An 8" x 10" piece of roof insulation with facing.
- Specifications for roof membrane, adhesives, and insulation.
- Installation instructions for all components.

(e) Installation of the roofing system is as follows:

- Roof Insulation: Install in accord with the roofing manufacturer's recommendations. Do not install more insulation than can be covered with membrane by the end of the work day. Butt boards tightly together, trim to fit so that gaps around penetrations do not exceed 1/4 inch. Stagger end joints at mid-point between adjacent joints.
- Roofing Membrane: Install perpendicular to the slope, with horizontal and vertical joints overlapped a minimum of 4".
- Flashing and Trim: Install all flashing and trim per the roofing manufacturer's instructions.
- Seams: Close field seams hot air seaming machine recommended by the manufacturer, operated in a manner to avoid damage to the membrane and flashings.

(f) All delivery, storage and handling of roofing components shall comply with the manufacturer's instructions to prevent components from being damaged, deformed, or stained.

(g) Warranty: The Contractor shall provide a 2-year labor and materials warranty according to the Standard Documents for Construction. The Manufacturer shall provide a minimum of a 10-year material warranty.

(h) Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:

- Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
- Review methods and procedures related to roofing installation, including manufacturer's written instructions.
- Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
- Review structural loading limitations of roof deck during and after roofing.
- Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
- Review governing regulations and requirements for insurance and certificates if applicable.
- Review temporary protection requirements for roofing system during and after installation.
- Review roof observation and repair procedures after roofing installation.

(i) General: The Contractor shall:

- Provided temporary roofing as required for continuous operation of the bridge.
- Accompany the manufacturer's technical representative during his warranty inspection.
- Assist the inspector and IDOT personnel with equipment and workmen when necessary to provide access to the roof.
- Carefully inspect and correct all defects noted.
- Prevent movement or storage of materials or equipment on the completed roofs.

(j) Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

- Notify Engineer or Owner 48 hours in advance of date and time of inspection.

Basis of Payment: The roofing system removal and replacement will be paid for at the contract unit price per each for **MEMBRANE ROOFING**.

STAIRWELL REHABILITATION

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and install the various components of the stairwell rehabilitation as shown on the Plans and in these specifications. Work includes removing existing door and door frames, constructing metal stud and gypsum board rated partitions, firestopping all penetrations or voids in existing masonry stairwell walls and between existing and new walls,

installing new door frames, new doors, and new door hardware. This work item includes hollow metal doors, hollow metal frames, and door hardware for doors not located in the stairwells. Both new and existing doors and frames will be painted. This work includes the removal of the existing ceiling and installation of a new ceiling in both Control Rooms.

Materials.

(a) Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Temperature-Rise Limit: At vertical exit enclosures, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Materials:
 - Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum G60 (Z180) metallic coating.
 - Frame Anchors: ASTM A 591, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 - For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
 - Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.
 - Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.
 - Acceptable Manufacturers:
 - a. Amweld Building Products, LLC.
 - b. Ceco Door Products; an Assa Abloy Group company.
 - c. Curries Company; an Assa Abloy Group company.
 - d. Fleming Door Products Ltd.; an Assa Abloy Group company.
 - e. Mesker Door Inc.
 - f. Steelcraft; an Ingersoll-Rand company.
 - g. Windsor Republic Doors.
3. Hollow Metal Door Frames:
 - Hollow Metal Door Frames: Comply with ANSI/SDI A250.8.
 - Fabricate frames as full profile welded unless otherwise indicated.
 - Fabricate exterior hollow metal door frames from 0.053 inch thick steel sheet.
 - Fabricate interior hollow metal door frames from 0.053 inch thick steel sheet.
 - Hardware Reinforcement: ANSI/SDI A250.6.
4. Hollow Metal Doors:
 - Hollow Metal Doors: Comply with ANSI/SDI A250.8.
 - Design: Flush Panel
 - Core: Insulated Exterior doors: Poly isocyanurate foam insulation.
Interior Fire Rated Doors: Mineral Board.
 - Vertical Edges: Beveled.

- Provide integral overlapping astragal on active leaf of pairs of doors.
- Top and Bottom Edges: Closed with same material as face sheets.
- Width: 1 ¾ inches.
- Fabricate exterior hollow metal doors from 0.063 inch thick steel sheet.
- Fabricate interior hollow metal doors from 0.048 inch thick steel sheet.
- Hardware Reinforcement: ANSI/SDI A250.6.

5. Door Hardware:

- Finish: All hardware to be US 26D, brushed chrome, finish or clear anodized aluminum.
- Basis of Design Locks BHMA 156.2 Grade 1 and BHMA 156.13 Grade 1:
Exterior Doors: Heavy Duty Mortise lockset, Best H series, Knob 4, Rose C.
Interior Doors: Heavy Duty Cylindrical Lockset, Best 8K Series, Knob 4, Rose C.
- Alternate Lock Manufacturers that utilize Best SFIC by Corbin-Russwin, Hager, Schlage, Sargent, or Yale are acceptable.
- Lock Cylinders: BHMA 156.5, Best "Peak" Patented Cylinder cores, SFIC, 7 pin core, 150 Series. No substitutions allowed.
- Manual Flush Bolts: BHMA 156.16 Grade 1, mortised into door edge of fixed leaf of a pair. Hager 282D or equal by Ives, Glynn-Johnson, or Stanley.
- Thresholds: BHMA 156. Grade 1, Hager 477S or equal by National Guard or Pemko.
- Dustproof strike: BHMA 156.16 Grade 1, Ives Model DP-1 or equal by McKinney or Rockwood.
- Hinges: BHMA 156.26 Grade 1, 4x4 Ball bearing stainless steel, butt hinges, non removable pin: Hager BB1191 or equal by McKinney, PBB Inc., or Stanley.
- Closers: BHMA 156.4, Grade 1, LCN 1000 Series surface mounted closer or equal by Norton, Sargent, or Yale.
- Door Gasketing: BHMA 156.22, Hager Model 878S, fire and smoke rated silicone gasket in clear anodized aluminum retainer, or equal by National Guard Products, Pemko, or Reese.
- Automatic door bottom: BHMA 156. Hager 740S Model 222SA or equal by National Guard Products, Pemko, or Reese.
- Wall Stop: BHMA 156.16, Grade 1, Hager Model 230W or equal by Ives or Rockwood, or Trimco.
- Floor Stop and Holder: BHMA 156.16, Hager Model 267F or equal by Ives, Rockwood, or Trimco.
- Drip cap: 2 ½ inch projection stainless steel drip cap, Hager Model 810S or equal by National Guard Products, Reese, or McKinney.

(b) Light Gauge Metal Framing:

- 25 gauge, 3 5/8" Steel studs and compatible runners complying with ASTM C 645.
- Provide ASTM A653 G40 hot-dip galvanized protective coating.
- Provide 17 gauge cold rolled furring channels.
- Isolation strip: Asphalt saturated organic felt, ASTM D 226, Type I, non- perforated.

(c) Gypsum Board:

- Provide: Moisture and mold resistant core and surfaces; 5/8 inches thick, Type X.
- Provide paper joint tape, setting type joint compound, hot dipped galvanized metal trim.
- Anchor with screws per manufacturers instructions.

- Confirm fire rated assembly at stairwell partitions.
- Acceptable Manufacturers:
 - a. American Gypsum Co.
 - b. BPB America Inc.
 - c. G-P Gypsum.
 - d. National Gypsum Company.
 - e. USG Corporation.

(d) Firestopping:

- Provide sealants, safing insulation, and other Firestopping materials from a single manufacturer.
- Acceptable Manufacturers:
 - a. A/D Fire Protection Systems Inc.
 - b. Grace, W. R. & Co. - Conn.
 - c. Hilti, Inc.
 - d. Specified Technologies Inc.
 - e. 3M; Fire Protection Products Division.
 - f. Tremco; Sealant/Weatherproofing Division.
 - g. USG Corporation.
- All Firestopping shall be designed and installed by a firm that has at least one Designated Responsible Individual (DRI) per FMG 4991, "Approval of Firestopping Contractors" or Underwriters Laboratories QFC program.

(e). Painting:

- Provide all coatings from a single manufacture to insure compatibility
- Hollow Metal Doors and Frames: Provide two coats of Master Painters Institute #81-Q.D. Enamel Semi-gloss on factory primed metal.
- Gypsum Board Partitions: Provide two coats of Master Painters Institute #141 Latex Semi-gloss over one coat of Master Painters Institute #50 Latex Primer Sealer.
- Colors as selected by Owner from manufacturer's standard colors.
- Acceptable Manufacturers:
 - a. Benjamin Moore.
 - b. ICI Paints.
 - c. PPG Paints.
 - d. Sherwin-Williams.

(f) Rubber Base:

- Type TS four inch coved rubber base, 0.125 inch thick, with preformed corners. Use coil stock to minimize joints. Select color from manufacturer's standard colors.
- Acceptable Manufacturers:
 - e. Burke Flooring Products.
 - f. Flexco, Inc.
 - g. Johnsonite.
 - h. Musson Rubber Co.
 - i. Roppe Corporation.

- Use Manufacturer's recommended low VOC adhesive.
- Apply rubber base to all gypsum board walls.

(g). Metallic Lay-in Ceiling:

- Carefully remove the existing ceilings in both Control Rooms.
- Suspended Metal Ceiling Grid: Aluminum, standard 15/16" exposed grid; brushed aluminum finish.
- Lay-In Ceiling Panels: Nominal 24 inch by 24 inch, flat, perforated aluminum ceiling panels with edges returned 90 degrees, brushed aluminum finish.
- Perforations approximately 0.2 inches in diameter, staggered pattern, 30 degree angle, approximately 50 percent open; Hunter-Douglas Standard perforation pattern #109.
- Alternate Manufacturers:
 1. Armstrong.
 2. Chicago Metallic.
 3. USG Interiors.

Construction Requirements.

(a) Hollow Metal Doors and Frames.

1. Installation of Hollow Metal Doors and Frames:

- Fabrication of Exterior doors:
 - j. Provide weep holes in the bottom of the doors. Seal joints in top of doors.
 - k. Provide Floor and minimum three jamb anchors per jamb as required.
 - l. Provide no silencers, exterior doors receive weather gaskets, interior doors receive smoke gaskets.
 - m. Prepare doors and frames for specified hardware. Reinforce as necessary.
 - n. Supply doors and frames with shop primer per ANSI/SDI A250.3
 - o. Seal perimeter of door frames with ASTM C 920 single component polyurethane sealant.

2. Installation of Door Hardware:

- Hardware installer shall have a keying conference with Owner prior to shop drawing submittal to confirm hardware operation and keying requirements. Installer shall have an AHC attend keying conference and prepare door hardware submittals.
- Provide construction cores for all locks during construction.
- Owner will install permanent cores and return construction cores to Contractor.
- Mount hardware at locations specified in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- Install all hardware according to manufacturer's written instructions.
- Set thresholds in a full bed of sealant.
- Door Hardware Sets:

Single interior fire rated door:

- 1 ½ Pair Hinges
- 1 Cylindrical Lockset – Passage Function
- 1 Door Closer

1 Wall Stop
1 Set Door Gaskets
1 Automatic Door Bottom

Single interior fire rated door at Toilet:

1 ½ Pair Hinges
1 Cylindrical Lockset – Privacy Function
1 Door Closer
1 Wall Stop
1 Set Door Gaskets
1 Automatic Door Bottom

Single exterior door:

1 ½ Pair Hinges
1 Mortise Lockset – Exit Function
1 Door Closer
1 Set Door Gaskets
1 Automatic Door Bottom
1 Threshold
1 Drip Cap

Pair of exterior doors:

3 Pair Hinges
1 Mortise Lockset – Entrance Function
1 Door Closer
2 Manual Flush Bolts
1 Set Door Gaskets
1 Automatic Door Bottom
2 Floor Stop/holders
1 Threshold
1 Dustproof strike
1 Drip Cap

(b) Installation of Light Gauge Metal Framing:

- Install tracks and studs adjacent to dissimilar materials with isolation strip between framing and dissimilar materials.
- Install studs at 16" on center.
- Provide cold rolled channel bridging at 4'-0" and 8'-0" above finished floor level.
- Provide double full length studs at doors.
- Install per UL wall design: U 419.
- Install light gauge metal framing plumb.

(c) Installation of Gypsum Board:

- Comply with ASTM C 840.
- Install per UL wall design: U 419.
- Provide metal trim at perimeter of gypsum board partitions.
- Screw gypsum board to light gauge metal framing.

- Apply tape and joint compound to a Level 4 finish.
- Protect installed products from damage.

(d) Installation of Firestopping:

- Installer shall visit site and verify what Firestopping is required to make the stairwell smoke resistant.
- Prepare penetrations according to manufacturer's written instructions.
- Apply Firestopping materials in thickness required to achieve specified fire rating.
- Identify firestopping systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of firestopping system, on both sides of the fire barrier at an interval no greater than 20 feet.
- Include the following information on the labels:
 - a. The words "Warning - Through Penetration Firestopping System – Do Not Disturb. Notify Facilities Department of any damage."
 - b. Date of installation.
 - c. Firestopping System Manufacturer name.
 - d. Installing Contractor name.
 - e. UL or FM tested assembly designation.
 - f. Name of installing technician.

(e) Paint Application:

- Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- Prep all surfaces per the Master Painters Institute Manual.
- Protect work of other trades against damage from paint application.
- At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

(f) Installation of Rubber Base:

- Comply with manufacturer's written instructions for installing rubber base.
- Do not stretch rubber base during installation.
- Clean any visible adhesive on wall, base or floor after installation.

(g) Metallic Lay-in Ceiling:

- Carefully remove the existing ceilings in both Control Rooms.
- Install new grid and perimeter angles per ASTM C 636, manufacturer's written instructions, and CISCA's "Ceiling Systems Handbook."
- Install metal pans per manufacturer's written instructions.

Submittals.

- The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications.
- The submittals shall include shop drawings and product data for door frames, doors, and door hardware, including a hardware schedule prepared by an AHC certified consultant.
- The submittals shall include product data for paint coatings.
- The submittals shall include shop drawings and product data illustrating the design for Firestopping materials at rated stairwells.

- The submittals shall include the fire ratings of proposed rated gypsum board partitions and fire stopping materials.

Basis of Payment. The installation of all components of the stairwell rehabilitation will be paid for at the contract unit price per Lump Sum for **STAIRWELL REHABILITATION.**

METAL WALL AND ROOF PANELS

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and install exposed fastener, lap seam, corrugated profile metal wall on existing wall framing and roof panels anchored to existing structure as shown on the Plans and in these specifications. Included in this work is the removal, disposal, furnishing and erecting of wall panel support members that are deteriorated (members that have more than 30% section loss or have rusted holes) or missing.

Materials.

- (a) "Galvalume" - Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality, 0.040-inch nominal thickness.
- (b) Surface: Smooth, flat finish.
- (c) Roof panels are Type B Roof Decking.
 1. Rib spacing: 6 inches.
 2. Panel Height: 1.5 inches.
- (d) Wall Panels are Centria Econolap ½ or equal by approved manufacturer.
 4. Rib spacing: Wall Panels; 2.67 inches.
 5. Panel Height: Wall Panels; 0.5 inches.
- (e) Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weather tight; and as recommended in writing by metal wall panel manufacturer.
- (f) Fasteners: SAE 303 stainless steel #10 self tapping screws with EPDM gaskets.
- (g) Flashing and Trim: Formed from 0.040-inch minimum thickness, aluminum-zinc alloy-coated steel sheet. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

Acceptable Manufacturers.

- (a) AEP-Span.
- (b) ATAS International, Inc.
- (c) CENTRIA Architectural Systems.
- (d) Fabral.
- (e) Flexospan Steel Buildings, Inc.
- (f) Industrial Building Panels.
- (g) MBCI; Div. of NCI Building Systems.
- (h) McElroy Metal, Inc.
- (i) Metal Sales Manufacturing Corporation.
- (j) Metecno-Morin.

Construction Requirements. Install metal wall panels vertically on existing steel purlins, and metal roof panels on existing structure with no panel splices. Install with gasketed screw fasteners with manufacturer's standard side lap. Trim panels to accommodate existing door frames and perimeter conditions.

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show size and layout of metal wall and roof panels, details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. materials specifications and tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Basis of Payment. The installation of metal wall and roof panels will be paid for at the contract unit price of lump sum for **METAL PANELS.**

ALUMINUM 1 INCH WINDOW BLINDS

Description. The work under this item shall consist of furnishing all the labor, tools, equipment and materials necessary to furnish, deliver and install new custom size painted aluminum mini blinds for all the windows in the bridge control rooms anchored to existing structure through wood blocking as necessary and described in these specifications. Provide two blinds on each elevation to cover the four windows on the north and south elevations and provide three blinds to cover the three windows on the east and west elevations in both Control Rooms. Provide a total of 20 blinds.

Materials.

- (a) Horizontal Louver Blinds, Aluminum Slats.
- (b) Manufacturer's standard painted finish color selection.
- (c) Width: 1 inch.
- (d) Head rail: Manufacturer's standard.
- (e) Bottom Rail: Manufacturer's standard.
- (f) Ladders: Manufacturer's standard.
- (g) Tilt Control: Manual wand.
- (h) Lift Control: Manufacturer's standard cord system..
- (i) Valance: Manufacturer's standard.
- (j) Mounting: Ceiling.

Acceptable Manufacturers.

- (a) Hunter-Douglas
- (b) Levolor
- (c) Springs Window Fashions.

Construction Requirements. Install 1x4 wood blocking to perimeter of existing ceiling. Fasten blinds to wood blocking using manufacturer's standard mounting clips.

Submittals. The Contractor shall submit for approval by the Engineer, shop drawings as required by Article 505.03 of the Standard Specifications. The shop drawings shall show size and layout of aluminum window blinds, and accessories; and special details. materials specifications and tolerances. The Contractor shall make his/her own field measurements without additional costs to IDOT.

Basis of Payment. The installation of aluminum window blinds will be paid for at the contract unit price of lump sum for **WINDOW BLINDS**.

MASONRY WALL CONSTRUCTION

Description:

This work shall consist of removal and reinstalling the masonry blocks as shown on the plans and as specified herein. This work is associated with structure # 016-0460 Cross Girder K repair work as shown in the plans.

When removing the existing masonry blocks, care shall be taken as to not damage existing structural steel members, adjacent surfaces or materials or adjacent constructions which are to remain. The Contractor shall be responsible for all expense and/or costs of repairing or replacing damaged masonry blocks in-kind, steel members, surfaces, materials or construction caused during the removal operations.

Method of Measurement.

This work will be measured in square feet.

Basis of Payment:

This work shall be paid for at the contract unit price per square foot for MASONRY WALL CONSTRUCTION.

REMOVAL OF EXISTING ALUMINUM RAILING

Description.

This work consists of removing and legally disposal of the existing aluminum rail sections at the locations indicated on the plans and according to the plan details.

All materials removed shall become the property of the Contractor and shall be disposed of by the Contractor off the site and in a lawful manner acceptable to the Engineer.

Removal Requirements. The Contractor shall submit, to the Engineer for review of the proposed method and equipment to be employed in the removal of the existing aluminum railing. Removal of the existing aluminum railing shall be done in a manner and sequence consistent with the sequence of the rehabilitation of the Bridge.

When removing the existing aluminum railing, care shall be taken as to not damage the existing structural steel members, adjacent surfaces or materials or adjacent constructions which are to remain. The Contractor shall be responsible for all expense and/or costs of repairing or replacing damaged steel members, surfaces, materials or construction caused during the removal operations. Repairs shall be done as directed by the Engineer and may include grinding, welding and/or member replacement depending upon location and severity of the damage.

The Contractor shall include all protection as required to prevent any materials produced during existing aluminum railing removal from falling into the river during such demolition operations.

Method of Measurement.

This work will be measured in feet. The length paid for will be the overall length along the rail from end to end.

Basis of Payment.

This work will be paid for at the contract unit price per foot for REMOVAL OF EXISTING ALUMINUM RAILING.

RAISED REFLECTIVE PAVEMENT MARKERS (BRIDGE, SPECIAL)

Description. This work shall consist of placing raised reflective pavement markers on the steel grid deck as shown on the plans or directed by the Engineer. The installation of the raised reflective pavement markers shall meet the requirements of Sections 781 and 1096 of the Standard Specifications, except as revised with this Special Provision.

Raised reflective pavement markers shall be installed in accordance with the following requirements:

- A. Raised pavement markers will be applied to the Steel Grid Deck by means of "J" Bolts approximately 1/4" to 5/16" in diameter. The "J" Bolts need not be cadmium or zinc coated. Holes approximately 1/8" larger than the bolt diameter will be carefully drilled through the top center of casing, taking care to damage neither the casing nor the reflector. The threaded portion of the "J" Bolt will be inserted through the casing hole, steel flat and lock washers will be placed around the bolt on top of the casing and a jam nut placed on the threaded portion of the bolt and turned several times atop the lock washer.
- B. The casing will be placed on the steel decking with the reflector facing oncoming traffic. The "J" Bolt will be inserted through the grate opening and affixed to the small 2" cross bar as noted on the sketch. The jam nut is to be tightened sufficiently to hold the reflector in place without shifting or damaging the casing. The excess threaded portion of the "J" Bolt above the jam nut will be removed by cutting with a Hacksaw or by grinding.

Raised Reflective pavement markers shall meet the requirements of Article 1096.01 of the Standard Specifications.

Basis of Payment. This work shall be paid for at the contract unit price each for RAISED REFLECTIVE PAVEMENT MARKER, (BRIDGE, SPECIAL) which price shall include furnishing the marker, complete with reflector, and installing the marker.

REPLACEMENT OF CENTER LOCKS

1. DESCRIPTION

The work under this item shall consist of removal and disposal of all existing center lock components and associated electrical components furnishing, installation aligning, adjusting, testing and painting of new center locks.

The center lock components to be removed shall include but not limited to the following:

- A. All existing lock bars, guides, socket assemblies and all associated components.
- B. All existing lock bar cranks, actuating linkages assemblies and associated components
- C. All existing lock machinery supports
- D. All existing limit switch assemblies
- E. All existing manual drive mechanisms and associated components
- F. All existing spur gears, reducer, shaft and keys
- G. All existing transverse line shafts, associated bearings and couplings
- H. Electric motors, brakes and all associated bearings and couplings
- I. All existing lubrication lines and associated components

The new center locks shall include but not be limited to:

- A. Furnishing and Installing New lock bar operator and all associated components.
- B. Furnishing and Installing New lock bars.
- C. Furnishing and Installing New lock bar guides and receivers.
- D. Furnishing and Installing New manual operating system and all associated components.
- E. Furnishing and Installing New lubrication system.
- F. Furnishing and Installing New manual operation mechanism.

Also included is the installation and connection of the lubrication lines from the roadway to the lock bar guides and receivers.

All mechanical work must be planned and coordinated with electrical and structural work as well as closures and restrictions to vehicular and navigational traffic.

2. MATERIALS

BAR OPERATOR

- A. Each operator system shall include a mechanical bar actuator that moves the 5-inch x 9 inch lock bar through a bar guide, situated on one leaf tip, and into a receiver on the other leaf tip. The gearing shall consist of two reductions using heat-treated, alloy steel helical gears on shafts supported by anti-friction bearings.
- B. Each operator shall be driven by a high starting torque, induction type, 5HP, 1800RPM, 3-phase, 60 Hertz, 240/480 volts, NEMA design D, frame B145TDZ, TENV electric motor having a 15 minute duty rating and equipped with a 3 ft-lb marine duty brake with manual release and safety interlock switch. The motor shall be totally enclosed, non-ventilated, equipped with ball bearings and designed especially for outdoor applications subjected to adverse weather conditions. Strip heaters shall be installed in the motor housing.
- C. Travel of the lock bars in each direction shall be governed by a two pole, snap action limit switch that provides two normally open and two normally closed contacts for each

length of travel. The lock bar shall take approximately 21 seconds to complete its 1-inch stroke and the operator shall be capable of delivering a thrust of 8800 pounds to the lock bar 50% stall torque of the motor. The housing containing the limit switches shall be equipped with strip heaters.

Lock Bars

The 5-inch x9 inch lock bar shall be ASTM A668 Class L, quenched and tempered and stress relieved forging. A hinged joint shall connect the lock bar to the actuator.

Guides and Receivers

The lock bar guides and receivers shall be energy absorbing type, which incorporates the span alignment guide on the guides and receivers such as Earle "cushionloks" type as manufactured by Steward Machine Co., Inc. or an approved equal.

Each guide and receiver shall have high strength bronze wear shoes supported by a combination of stiff springs that permit some vertical movement of the shoes. When the lock bar is inserted into the guide and/or receiver it shall cause the shoe to depress the springs slightly resulting in a preloaded condition that will ensure continuous firm contact between the lock bars and the shoes.

The selection and design of the system shall be such that the relationship of the minimum and maximum stresses is correct for infinite fatigue life of the energy absorbing spring system. Adjustment of the pre-load between the shoes and the lock bar shall be possible without disassembly of the guides or receivers.

Manual Operators Assembly

The center lock system shall have a manual drive connected through a series of the horizontal and vertical shafts to the road way. Each system shall be installed with movable hand crank as shown in the contract plans.

Limit switches indicating the limits of bar travel shall be provided. Additional limit switches that disengages the main electrical system when the removable key assembly is inserted into the manual drive assembly at the roadway shall be provided.

The contractor shall furnish and install pulleys and rope system as shown on the contract plans to release the brake during manual operation of the span locks. The brakes shall be returned to their normal position after the manual operation and the closing of the hatch. The shop drawings shall detail the size of the pulleys and the rope system arrangement as shown on the contract plans.

3. CONSTRUCTION REQUIREMENTS

Removal of Existing Span Locks

The contractor shall remove and discard all center lock machinery: including but not limited to drive motor, speed reducer, shafts gears, clutches, connecting rods, links, rod guides, lock bars, lock bar guides and receivers and all mounting hardware. Before any work is undertaken on the center lock systems, submit a detailed plan to the engineer for the removal of the existing center lock and installation of the new center locks.

The contractor shall at any time after removal of the existing center locks the bridge is opened to the passage of vehicular traffic; provide temporary span locks at the leaf tips.

Installation, alignment and adjustment of the span lock systems shall all be made only under the supervision of personnel who are experienced and qualified with previous experience in the installation and adjustment of moveable bridges mechanical machinery. The span lock equipment shall be installed, aligned and adjusted by competent millwrights skilled in the type of work involved, provide all necessary measuring, alignment and leveling instruments as may be required.

The contractor shall shop assemble and inspect all the span lock machinery to assure correct fits and assembled dimensions as required by the contract documents. Any components requiring disassembly for installation shall be match marked to enable proper assembly on the bridge leaves.

Upon completion of the span lock systems, submit a testing procedure and schedule to the engineer as outlined in the Bridge Machinery-General.

The tests shall demonstrate the machinery is in correct working order, in full compliance with the contract documents, general and special provisions. Correct, adjust or replace as necessary any irregular operation, evidence of distress, improper functioning, defective or inadequate components revealed during the test, before final acceptance, without additional cost to the department.

4. METHOD OF MEASUREMENT

The department will measure center lock systems, completed in accordance to the contract and accepted as a single complete unit of work.

5. BASIS OF PAYMENT

The work under this Item will be paid for at Contract unit price each for **REPLACEMENT OF CENTER LOCKS**.

MECHANICAL

MECHANICAL ITEMS

Description

This section consists of the general construction requirements for all mechanical items work described in the Plans and these Special Provisions.

The work included under this section shall consist of furnishing all labor, materials, plants and incidentals required to rehabilitate the mechanical components in accordance with the Plans, Specifications, and the directions of the Engineer.

Scope of Work

The work shall include, but not be limited to the following tasks:

1. Mechanical Demolition
2. Rehabilitation of Operating Machinery:
 - A. Replacement of Main Motors
 - B. Replacement of Motor Brakes
 - C. Replacement of Machinery Brakes
 - D. Re-furbishing of Main Pinion Bearings
 - E. Replacement of Lubrication System
 - F. Lubrication and Painting of all Mechanical Components.
3. Replacement of Center Locks
4. Non Destructive Testing (NDT)
5. Replacement of Trunnion Thrust Collar Assemblies
6. Replacement of Trunnion Bearing Cap and Anchor Bolts
7. Refurbishment of Live Load Bearings
8. Bascule Span Balance
9. Replacement of Traffic Gates
10. Replacement of Barrier Gates
11. Replacement of Sump Pumps

The following shall also be included in the work:

1. Any apparatus, appliance, material, labor or service either shown on the Contract Drawings or noted in the Specifications.
2. Any incidental apparatus, appliance, material, labor, service of a minor nature, necessary to make the work complete in all respects, and ready for operation, even if not particularly shown on the Contract Drawings or mentioned in the Specifications.
3. Small details not shown on the Contract Drawings or specified, but which are necessary for the proper and complete installation and operation of the work.

4. Detailed field measurements of the elevations and relative positions of the existing pinions and pinion shafts. A reference line shall be established through the centers of the pinions and the alignment of the pinion shafts to the reference line and of the reference line to the structure shall be established with a resolution of 1/64".
5. Demolition of the existing equipment to be replaced shall be included under this item. The contractor shall coordinate the dimensions given on the mechanical plans with actual dimensions of the approved manufactured components, bascule pier, bascule span and the electrical plans to insure proper fit and to provide adequate clearances against all moving components.
6. Electrical work shown on the plans and described in the specification for electrical work shall be provided under the Bridge Electrical work shall be provided under the bridge electrical lump sum item. Any additions or modifications to the electrical work so indicated required for the connection or operation of the mechanical systems provided under the mechanical items shall be included in the price of these mechanical items, to be provided and installed in accordance with the requirements of the work specified Electrical.

General Requirements

1. References

AASHTO Standard Specifications for Movable Highway Bridges, 1988.
AASHTO M164 High Strength Bolts for Structural Steel Joints (ASTM A325).
AASHTO M183 Structural Steel (ASTM A36).
AASHTO M222 High Strength Low-Alloy Structural Steel with 50,000 psi minimum – Yield Point to 4 in. Thick (ASTM A588).
ANSI B4.1 Preferred Limits for Cylindrical Parts.
ANSI B46. 1 Surface Texture.
ANSI Y14.5M Dimensioning and Tolerancing.
ASME B18.3, Sock Cap, Shoulder, and Setscrews, Inch Series.
ASTM A 148 Grade 90/60 Cast Steel.
ASTM A 449 Quenched and Tempered Steel Bolts and Nuts.
ASTM A 563 Carbon and Alloy Steel Nuts.
ASTM A 668 Steel Forgings, Carbon and Alloy
AWS A2.0, Standard Welding Symbols.
AWS D1.5, Bridge Welding Code.

2. Qualifications, Personnel and Facilities

The Contractor for this project, or his Mechanical Subcontractor shall be responsible for and experienced in all aspects of mechanical construction for bascule bridges, including attending all meetings related to mechanical issues, reviewing and approving all mechanical submittals, checking and verifying bascule leaf alignment throughout the fabrication and erection stages, supervising mechanical system field installations and coordinating all mechanical aspects among subcontractors and manufacturers, and also with the structural, electrical and architectural interfaces.

The Contractor shall demonstrate that his staff personnel or those of his Mechanical Subcontractor, who are assigned to this project, have over 10 years' experience in setting and aligning heavy machinery, and who have performed installation of machinery for a minimum of five trunnion type bascule bridges. The Contractor shall submit the qualifications of the proposed millwrights to the Engineer for review and approval.

The contractor shall employ millwrights for setting and aligning all mechanical items and systems and to verify and document all alignment. The millwrights shall have a minimum of ten years in setting and aligning heavy machinery and who have performed installation of machinery for a minimum of five movable bridges. The Contractor shall submit this information this information for approval, 10 days after award of contract.

The Contractor shall provide adequate plant, material, and personnel for proper execution of the work. The work shall be managed in a professional manner and in compliance with all applicable safety regulations. Contractor's superintendent, who is fully authorized to act on behalf of the Contractor, shall be continuously present at the site during the work. The Contractor will be responsible for repairs of all damage to the bridge, the bridge equipment, and surroundings that result from the Contractor's operations.

3. Quality Assurance

1. Total Quality Assurance (TQA) program shall be prepared for the project by the Contractor for all work completed under the requirements of Mechanical Items. TQA program documentation shall be submitted to the Engineer for review. The following shall be included:
 - A. Test Records
 - B. Workers welding certificates
 - C. QA/QC programs
 - D. Work plan
 - E. Mill certification
 - F. Materials certifications
 - G. Test results for this project
 - H. Plant certifications by independent test agencies demonstrating compliance with this requirement.

Quality Assurance Plans shall also be submitted for brake manufacturer, barrier and warning gates manufacturer, span lock manufacturer, casting and forgings manufacturer and as specified herein.

All submittals for bridge machinery required under this special provision and prepared by the Contractor shall be under the responsible charge of one lead Engineer who shall coordinate the work with other components of the design and construction, and review all submittals for conformance to the project Plans and Specifications.

The lead Engineer shall be professionally licensed in the State of Illinois in the branch of Mechanical Engineering and shall seal and sign all Quality Assurance submittals.

4. Codes and Standards

1. Work under this project shall comply with, but not be limited to the latest editions of the applicable requirements of the codes, standards, and references as listed below with their abbreviations. The applicable edition shall be that in force on the bid date.
 - A. American Association of State Highway and Transportation Officials, Standard Specification for Movable Highway Bridges AASHTO
 - B. American Iron and Steel Institute AISI
 - C. American National Standards Institute ANSI
 - D. American Society for Testing and Materials ASTM
 - E. American Welding Society AWS
 - F. National Lubricating Grease Institute NLGI
 - G. Steel Structures Painting Council SSPC
 - H. American Bearing Manufacturers Association WRTB
 - I. American Society of Mechanical Engineers ASME
 - J. American Gear Manufacturers Association AGMA
 - K. American Bearing Manufacturers Association ABMA
 - L. American Institute of Steel Construction AISC
 - M. Association for Non-destructive testing ASNT
 - N. Society of Automotive Engineers SAE
2. The work shall meet the requirements of all other codes and standards as specified elsewhere and in these special provisions. Where codes and standards are mentioned for any item, the intent is to call particular attention to them; it is not intended that any other applicable codes and standards shall be assumed to be omitted if not mentioned.
3. Particular attention is directed to Division IV, Part 4.1.10 of the AASHTO Standard, which requires tests of the span operating machinery. All such tests shall be performed by the Contractor.
4. Rules, Regulations and Ordinances
 - A. Work shall comply with all applicable Federal, State and Local rules, regulations, and ordinances. The Contractor shall include in the cost of this item all work necessary to obtain permits and approvals of authorities and agencies having jurisdiction, as required.
 - B. In the event of a conflict between these Specifications and the above mentioned codes, standards, rules, regulations, and ordinances, the most stringent requirement shall apply. All machinery and machined components shall be fabricated, built, machined and constructed in accordance with both AASHTO Standards and general industrial machine practice. If any contention of interpretation of AASHTO Standards arises, the accepted machine practices as described in Machinery's Handbook (28th or later editions) shall prevail. The Engineer shall have final decision making authority in matters regarding engineering contention.

5. Basis of Machinery Design

The design of new machinery shall conform to the applicable requirements of AASHTO Standard Specifications for Movable Highway Bridges, 1988 (1988 AASHTO).

The design of the operating machinery is based upon the new 75 H.P A.C electric motors operating at 530 rpm and a maximum torque not exceeding 150% of rated full load torque.

6. Operating Parameter

- A. The operating machinery is designed to open both leaves of the bascule span 77 degrees with respect to the fully closed position under Load Conditions A, B and C as specified in Paragraph 2.5.3 of 1988 AASHTO.
- B. All machinery components shall be suitable for operation in ambient temperatures of minus -20 degrees Fahrenheit to plus 120 degrees Fahrenheit. This shall be accomplished by using suitable lubricants and/or heaters.
- C. All components shall be capable of functioning normally throughout the full angle of operation.

7. Measurements and Verifications

- A. Dimensions indicated on the Contract Drawings are nominal and are intended for guidance only. All variations from the nominal dimensions on the Contract Drawings shall be noted on the shop drawings.
- B. The Contractor shall verify all dimensions of the existing bridge machinery to remain, structure, and foundation relating to the new machinery and shall record them on the shop drawings.

8. Substitutions

- A. If any departures from the Contract Drawings or these Specifications are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted in writing as soon as practicable to the Engineer for review. No such departures shall be made without written approval of the Engineer.
- B. Shop Inspection and Testing
 - 1. Visual inspection of the shop-assembled machinery and associated components shall be made by, and shop tests shall be witnessed by the Engineer. The Contractor shall give not less than ten (10) working days notice to the Engineer of the beginning of work at foundries, forge, and machine shops so that inspection may be provided. No materials shall be cast, forged, or machined before the Engineer has been notified per the above.

2. The Contractor shall furnish all facilities for the inspection of material and workmanship in the foundries, forge, and machine shops.
3. The Inspector shall have the authority to reject any material or work that does not meet or fulfill the standards or quality requirements of the Contract Drawings, Specifications or these Special Provisions.
4. Inspection at the foundries, forge, and machine shops is intended as a means of facilitating the work and avoiding errors. It is expressly understood that inspection does not relieve the Contractor from responsibility in regard to imperfect material or substandard work and the necessity for replacing defective materials or upgrading inferior quality work that are delivered to the job site.
5. Unless otherwise provided, the Contractor shall furnish without additional charge material test coupons, samples or specimens as required, and all labor, testing machines, tools, and equipment necessary to prepare the specimens and to make the physical tests and chemical analyses required by the material specification for the particular product. Copies of all test reports and chemical analyses shall be furnished to the Engineer.
6. The Contractor shall furnish the Engineer with a copy of all orders covering work performed by subcontractors or suppliers.
7. The acceptance of any material or finished parts by the Engineer shall not prevent their subsequent rejection if later found to be defective. Rejected material and workmanship shall be replaced or made acceptable by the Contractor at no additional cost to the Department.

9. Guarantee and Warranties

The Contractor shall obtain and assign to the Department or the agency or authority having jurisdiction over the bridge, all manufacturer's warranties or guarantees on all equipment, material or products furnished for or installed as part of the work.

The Contractor shall warrant the satisfactory in-service operation of the mechanical equipment, materials, products, and related components. This warranty shall extend for a minimum period of one-year following the date of final acceptance of the entire Project, including balancing.

10. Shop Assembly

- A. Shop assembly shall be made prior to shipment to verify the fit and the performance of the various parts. The following assemblies shall be assembled in the shop, tested and shipped as assemblies herein:
- B. Motor pinions shall be installed on their respective motor shafts in the manufacturer's shop with the specified fit specified on the Contract Drawings, including keys and set screws, if used.

- C. Lock machinery assemblies shall be tested on their respective supports and guides in a shop prior to shipping to the field installation.

11. Delivery and Storage

A. Protection for Shipment

1. All finished metal surfaces and unpainted metal surfaces that could be damaged by corrosion shall be coated with the rust-inhibiting preservative as soon as practicable after finishing. This coating shall be removed from all surfaces to be lubricated immediately prior to lubrication for operation and from all surfaces prior to painting after installation. All shims shall be coated prior to shipment with the rust-inhibiting preservative, and immediately before installation this coating shall be wiped from the shims that are used.
2. All machinery parts shall be completely protected from weather, dirt, and all other injurious conditions during manufacture, shipment, and while awaiting installation. All shaft journals that are shipped disassembled from their bearings shall be protected during shipment and before installation by coating with rust-inhibiting preservative and in addition, by wrapping in metal backed cloth or paper saturated with vapor phase corrosion inhibitors, secured in place with metal or reinforced nylon strapping. Shafting shall be shipped in a heavy wooden or metallic box with internal circular support cradles. Other smaller elements shall be wrapped and shipped in similar secure boxes surrounded by Styrofoam or polyurethane foam. All boxes shall contain multiple packets of silica gel. Boxes shall be securely strapped and marked as to contents and destination. Every precaution shall be taken to ensure that journal surfaces will not be damaged during shipment. Each assembly and part shall be tagged with the part number corresponding to the designation used on the approved shop drawing.
3. The Engineer shall approve the methods and materials used for protection. The Contractor shall submit in advance an outline of the methods and materials to be used for this purpose. No machinery shall be stored outdoors. All equipment shall be properly protected per the manufacturer's recommendation when stored prior to installation or activation.

B. Packaging and Delivery of Removed Parts

1. Removed parts shall be protected for shipment and prolonged storage by coating, wrapping and boxing in uniform size wooden boxes of substantial construction.
2. All removed parts shall be durably tagged or marked with a clear identification using the designation used on the approved shop drawing.

3. Boxes of spare parts shall be clearly marked on the outside to show their contents.

4. Spare parts shall be delivered to a suitable location directed by the Engineer. The delivery location shall be within District 1.

12. Defective Materials and Workmanship

- A. All machinery rejected during inspection and testing shall be removed from the site and replaced without additional cost to the Department.
- B. Delays resulting from the rejection of material, equipment or work shall not be the basis of any claim by the Contractor.

The Contractor at no additional cost to the Department shall correct all defects found in the work resulting from faulty material, components, workmanship, or installation.

Materials

1. General

- A. All materials shall be as called out on the Contract Drawings and as indicated in the Specifications.
- B. The current issue of all material specifications and standards shall be those in effect on the date of the bid for this project.
- C. All materials furnished for machinery work shall be new except as noted, clean, and free of defects.
- D. Material on the Contract Drawings not covered by Material Specifications shall be commercially available material acceptable to the Engineer.

2. Record Drawings

- A. The Record Drawings for the existing Congress Parkway of the South Branch of the Chicago River Bridge are available at the Illinois Department of Transportation, District 1 Office, 201 West Center Court, Schaumburg, IL 60196. Contact: Brian Kuttub at 847-705-4431.

3. Ferrous Metals

- A. Ferrous Metals shall be furnished in the following forms:
 - 1. Steel Forgings
 - 2. Steel Castings
 - 3. Structural Steel Shapes and Plates
 - 4. Steel Bars, Hot-Rolled and Cold-Rolled
 - 5. Steel Sheets
 - 6. Cold-formed Rectangular Steel Tubing
 - 7. Hot-Rolled Pipe and Tubing

- B. Brinell or Rockwell hardness tests shall be made and recorded on inspection reports of all steel parts for which hardness values specified on the Contract Drawings or required by the applicable material specifications.
 - C. All rough-machined forgings supplied to the Contractor or sub-contractor shall be homogeneous, free of voids, large inclusions, seams, forging laps, cracks or internal shrinkage cavities or other injurious defects. Forging stock shall be derived from blooms, continuously-cast bars or ingots which have sustained a reduction in cross-sectional area by a factor of 3 or more by hot working. The forgings shall have a fine grain size of ASTM 5 or greater. Forgings shall be hot worked at known forging temperature ranges established for the specified alloy grade, such as those listed in the American Society for Metals Heat Treater's Guide or other authoritative reference. Forgings shall be ordered in sizes with sufficient machining allowance for machining to final dimensions. Forgings shall be ultrasonically tested in accordance with ASTM A388. Charpy V-notch and tensile specimens shall be taken from forging prolongations in the longitudinal direction as per ASTM A668. Any defects found in the forging shall be repaired only when feasible, and repair procedures shall be submitted for approval by the Engineer.
 - D. All steel castings shall be free of cracks, cold shuts, shrink holes, blowholes, sand pockets and porosity. All steel castings shall be cleaned free of loose sand and scale. All irregularities shall be removed. All unfinished edges of castings shall be neatly cast with rounded corners and all inside angles shall have adequate fillets consistent with good foundry practice. All surfaces requiring finish shall have adequate material allowance for machining to finish dimensions. Bolt holes in steel castings shall be drilled through the solid material. All bolt holes through castings shall be spot faced for bolt heads, nuts or washers. Castings, which show or develop cracks, flaws, or other defects during hammering or from any other cause, shall be rejected in accordance with the requirements of ASTM A27, ASTM A148, or ASTM A781. The steel casting shall be thermally stress-relieved after shakeout, cleaning and rough grinding, by slowly heating at 100°F/hour to 1100°F, holding for 1 hour, then slowly cooling at 100°F/hour until 600°F, when it will be air cooled in still air. Charpy impact and tensile bars may be taken from the casting or from separately cast test bars as per ASTM A781. Castings shall be ultrasonically tested in accordance with ASTM A609. Maximum tolerable internal flaw size shall be 3/8" in the long direction or diameter. Any defects found in the casting shall be repaired only when feasible, and repair procedures shall be submitted for approval by the Engineer
4. Non - Ferrous Metals
- A. Copper-based bronze alloy castings shall be centrifugally cast per ASTM B271 to rough or nominal dimensions, and machined to final dimensions. Castings shall be free of voids, porosity, gas entrapment, cracks, shrinkage, or other injurious defects. The non-machined areas shall have a fine, shot-blasted finish.

Machined and ground areas shall be protected before shipment to prevent any damage or contamination during shipping. Test bars for tensile and impact tests shall be taken either from the actual casting or from castings in separate molds from the same heat as described in ASTM B208. Castings shall be ultrasonically inspected in the same manner as per ASTM A388, except that cast bronze calibration blocks shall be used. Maximum tolerable internal flaw size shall be 1/4" for bronze. Any defects found in the casting shall be repaired only when feasible, and repair procedures shall be submitted for approval by the Engineer.

- B. Brinell or Rockwell hardness tests shall be made and recorded on inspection reports of all bronze castings for which hardness values are specified by the applicable material specifications.
- C. All wrought copper-base alloys in plate or bar form shall conform to pertinent ASTM specifications as noted on the plans.

Construction Requirements.

1. General

- A. The Contractor shall take all necessary safety measures to protect the public and the waterways from any falling debris, materials, tools or equipment during all field operations, as approved by the Engineer including but not limited to safety netting, protective shields, special work platforms, temporary lighting and the like.
- B. The Contractor shall submit to the Engineer for approval the procedures, equipment, and methods to be used for this work. The procedures and methods shall be approved before the work begins.
- C. Removal and disposal of all designated existing structural and mechanical components, regardless of type and material, shall conform to applicable provisions of the Standard Specifications, Contract Drawings, or as directed in writing by the Engineer.
- D. All work, including but not limited to fabrication, storage, inspection, transportation, erection and connections shall be in accordance with the provisions of the Standard Specifications, Contract Drawings and Engineer's directions.
- E. The Contractor shall verify all dimensions in the field prior to ordering and fabrication in order to ensure proper installation.
- F. Shop drawings for all replacement items shall be prepared, approved and distributed in accordance with the provisions of the Standard Specifications. The shop drawing submission shall include the name of the fabricator and the fabricator's technical specifications.
- G. No material or equipment shall be ordered or fabricated prior to approval by the Engineer of shop drawings, fabrication procedures and specifications.

- H. In the event any new or existing materials are damaged during this work, due to Contractor's operations, the Contractor shall repair or replace the damaged materials in a manner satisfactory to the Engineer, at no additional cost to the Department.
2. Qualification, Personnel and Facilities
- A. The Contractor shall use an adequate number of skilled, trained, and experienced machinists and millwrights for the installation and testing of the bridge operating machinery. Machinists and millwrights shall be thoroughly familiar with the specified requirements and methods for the proper execution of the work. Qualifications and prior experience resumes of millwrights and field machinists shall be submitted for approval prior to commencing any on-site work by these personnel.
- B. The Contractor shall provide supervising personnel and Engineers with experience in the design and installation of machinery for at least one previous movable bridge project, and with previous experience in replacing drive machinery components of at least one bascule bridge.
- C. The Contractor or any Subcontractor shall provide adequate plant and all tools, instruments and facilities required for the performance of the personnel engaged in the execution of the specific work.

3. Rejection

The acceptance of any material or finished members by the Engineer shall not preclude their subsequent rejection, if found defective.

Components with out-of-tolerances dimensions will be rejected.

Rejected materials and workmanship shall be replaced within 90 days by Contractor at no additional cost or extension of Contract time to complete the work.

4. Disposal

All existing parts of the bridge machinery, which are dismantled, and are no longer required for assembly as part of the machinery rehabilitation, shall be disposed of as shown on the Contract Drawings.

5. Field Installation

- A. All parts of the machinery shall be assembled and erected in accordance with erection marks and match marks. Before final drilling or reaming all parts shall be precisely adjusted for correct alignment by means of shims or collars furnished for each part and securely clamped. After final alignment and bolting, all parts shall operate smoothly, quietly, and without vibration.

- B. Bolt holes in supporting structural steel for connecting machinery bases shall be drilled from solid metal after final alignment of the machinery unless otherwise indicated on the Contract Drawings. Erection holes, sub drilled ¼ inches undersize for undersize temporary bolts, may be used for erection and alignment of the machinery. When the machinery is aligned in its final position, the undersize holes used for temporary bolts shall then be drilled and reamed full size and full-size bolts installed to complete the installation.
- C. ASTM A490 bolts shall be torqued to the same tension required for A325 bolts in structural steel as required by ASTM. All bolts shall be tightened by the turn-of-the nut method. All fasteners shall be torqued to 70% of their yield strength to provide adequate preload and to extend their fatigue life. The contractor shall use the torque table below. The table is based on their yield strength of the various bolts specified in the mechanical items.

Torque Table for Various Bolts
(values in ft-lbs)

Bolt Size	A325	A325	A449	A449	A490	A490
	Machine Oil	Copper anti-seize	Machine Oil	Copper anti-seize	Machine oil	Copper anti-seize
½-13 UNC	80	50	80	50	115	70
¾-10 UNC	280	175	280	175	400	250
7/8-9 UNC	450	285	450	285	645	405
1-8 UNC	600	375	600	375	965	605
1 ¼-7 UNC	1200	755	1200	755	1930	1210
2-4 ½ UNC	NA	NA	2030*	1275*	NA	NA

NOTE: Torque values in this table generate stresses in the bolts equal to 70% of their minimum rated yield strength, and were rounded to the nearest 5 ft-lbs. The average nut factor coefficient for machine oil as a thread lubricant was taken as 0.21; for copper anti-seize thread lubricants, 0.123.

NA = bolts not available in this size

**For bolts or shafts of 2" or more in diameter, only 40% of yield strength is recommended, due to the difficulty of applying such a large torque and because of the depth of the threads.*

- D. All surfaces in contact with bolt heads and nuts shall be clean and free of grease and paint.
- E. After erection is complete and prior to the Contractor's inspection, all machinery components shall be lubricated with the lubricants listed on the lubrication charts.
- F. The Contractor shall perform the initial application of lubricant at machinery installation and all subsequent lubrication applications required prior to turning over the bridge to the Department.

6. Contractor's Inspection

- A. After erection is completed, before the bridge is operated, the Contractor shall make a thorough inspection to ensure that all gears are clean and free of obstruction, that all parts are properly aligned and adjusted as closely as practicable (without actual operation), and that all bolts are properly tightened.
- B. Inspection of tightened fasteners shall be in accordance with AISC Specifications. The Contractor's inspection shall also verify that field painting has been performed as specified herein. Touch-up painting shall be performed to correct all painting defects found during this inspection.
- C. The Contractor's inspection shall also verify that all machinery components have been lubricated as specified herein.
- D. The Engineer, during his final inspection before machinery testing shall accompany the Contractor. On the basis of the results of this inspection, the Engineer shall determine whether the bridge is ready for testing.

7. Fasteners and Bolt

- A. The following requirements for bolts, nuts, cap screws and washers shall apply, except where otherwise called for herein or on the Contract Drawings.
- B. All bolts for connecting machinery parts to each other or to supporting members shall be as shown on the Contract Drawings or specified otherwise and conform to one of the following types:
 - 1. Machinery Fit, high strength bolts
 - 2. Structural Fit, high strength bolts
 - 3. Turned bolts, turned cap screws and turned studs
- C. All high strength bolts shown on the mechanical drawings shall be machinery fit unless otherwise noted. All high strength bolts shall meet the requirements of ASTM A449 Type 2.
- D. Holes for machinery fasteners shall be reamed to 1/32" larger than for nominal bolt diameters less than 1", and 1/16" for fasteners 1" diameter or larger.
- E. Structural Fit high strength bolts shall have a maximum clearance of 1/16 inch between the bolt shank and hole.
- F. Both Machinery Fit and Structural Fit high strength bolts shall be connected using nuts meeting the requirements of ASTM A563 Grade DH or DH3 and shall be installed with a hardened plain washer meeting ASTM F436 at each end.
- G. Turned bolts, turned cap screws, and turned studs shall have turned shanks and cut threads. Turned bolts shall have semi-finished, washer-faced, hexagonal heads and nuts. Turned cap screws shall have finished washer-faced,

hexagonal heads. All finished shanks of turned fasteners shall be 1/16 of an inch larger in diameter than the diameter of the thread, which shall determine the head and nut dimensions. The shanks of all turned fasteners shall have Class LC6 fit in the finished holes in accordance with ANSI Standard B4.1. Inner surfaces of the holes for turned bolts, and the shanks of turned bolts, shall have a maximum surface roughness of 63 micro-inches. The material used for machining turned shank fasteners shall meet the requirements of ASTM A193, Grade B7. Turned bolts shall be secured using nuts meeting the requirements of ASTM A194 or A563 Grades DH or DH3. Turned fasteners shall be fully detailed on shop drawings.

- H. The dimensions of countersunk hexagon socket-head cap screws shall conform to ANSI B18.3, and the screws shall be made of heat-treated alloy steel, zinc or nickel plated and furnished with a self-locking nylon pellet embedded in the threaded section. Set screws shall be of the headless safety type, shall have threads of the coarse thread series, and shall have cup points. Set screws shall neither be used to transmit torsion nor as the fastening or stop for any equipment that contributes to the stability or operation of the Bridge.
- I. Bolt holes through unfinished surfaces shall be spot faced for the head and nut, square with the axis of the hole.
- J. Unless otherwise called for, all bolt holes in machinery parts or connecting these parts to the supporting steel work shall be sub drilled at least ¼ inch smaller in diameter than the bolt diameter and shall be reamed assembled for the proper fit at assembly or at erection with the steel work after the parts are correctly assembled and aligned.
- K. All elements connected by bolts shall be drilled or reamed assembled to assure accurate alignment of the whole and accurate clearance over the entire length of the bolt within the specified limit.
- L. Holes in shims and fills for machinery parts shall be reamed or drilled to the same tolerances as the connected parts at final assembly.
- M. Positive locks of an approved type shall be furnished for all nuts except high strength bolts. High-strength bolts and nuts if fully torqued per AASHTO Standards are self-locking and need no additional locking devices. If double nuts are used, they shall be used for all connections requiring occasional opening or adjustment, and shall be shown on the Contract Drawings.
- N. All cotters shall conform to the SAE standard dimensions and shall be made of half-round stainless steel wire, ASTM A276, Type 316.
- O. All fasteners shall be of United States manufacture and shall be clearly marked with the manufacturer's designation. The Contractor shall have on site a set of micrometers and bore micrometers capable of measuring bolt and bore diameters. The Contractor shall check that bolt clearances meet specifications before assembly.

- P. Unless otherwise noted on the Contract Drawings, all threads for bolts, nuts, and cap screws shall conform to the coarse thread series and shall have a Class 2 tolerance for bolts and nuts or Class 2A tolerance for bolts and Class 2B tolerance for nuts in accordance with the ANSI B1.1, "Unified Screw Threads."
 - Q. The threads of all mounting bolts shall be coated with anti-seize compound before assembly of the nuts to prevent corrosion or galling and to facilitate future removal if necessary.
 - R. Anti-seize compounds shall be as manufactured by the following companies, or approved equal:
 - 1. Huron Industries, Port Huron, MI: Neolube #1
 - 2. Fel-Pro, Inc, Skokie, IL: #C-670
 - 3. SPS Technologies Unbrako, Jenkintown, P
8. Shafts
- A. Shafts shall be of material specified in the Contract Drawings, and shall be tested for the required mechanical properties, and test certificates shall be furnished to the Engineer. Shafts shall be free of camber and shall run without vibration, noise, or chatter at all speeds up to and including the maximum operating speed.
 - B. The distance between shaft end connections may vary from the distance calculated from dimensions shown on the contract drawings due to final alignment considerations. As a result the required length of the shafts may vary.
 - C. The surface of shafts shall be accurately machined, round, smooth and straight.
 - D. All shafts shall conform to tolerances in ASTM A29 for hot rolled bars and A108 for cold-finished bars unless otherwise indicated on the Contract Drawings. Turned, ground and polished shafting straightness tolerances shall be 0.002 inches per foot for shafts up to and including 1 ½ inches in diameter and 0.005 inches per foot for shafts over 1 ½ inches in diameter.
 - E. Both ends of shafts shall have a suitable 60-degree lathe center, with clearance hole, at the exact center.
 - F. Where the Contract Drawings require steps in the shaft, fillets shall be blended smoothly to adjacent diameters and the fillets shall have a minimum radius of 1/8 inch and surfaces shall have an ANSI B46.1 maximum roughness of 32 micro-inches, unless otherwise shown on the drawings.
 - G. All journal bearing areas on the shaft shall be accurately turned, ground and polished without tool marks or scratches on the journal surface of adjoining shoulder fillets. Surface finish of shaft journals shall have an ANSI B46.1 maximum roughness of 8 micro-inches, unless a finer finish is indicated in the Contract Drawings.

- H. Shaft journals that are shipped disassembled from their bearings shall be protected during shipment and before erection by a packing of oil-soaked waste secured in place by burlap and covered with heavy metal thimbles or heavy timber lagging securely attached. Every precaution shall be taken to ensure that the bearing surfaces are not damaged and that all parts arrive at their destination in satisfactory condition.
- I. The Contractor shall be responsible for machining or shimming the inboard end of the two appropriate pinion shafts for attachment of the existing drum controllers switches.

9. Hubs and Bore

- A. The hubs of all gears, wheels, and couplings shall be finished on both faces and polished where the hub face performs the function of a collar to prevent shaft movement. The hubs shall be bored concentric with the rims of gears and wheels or with the outside of couplings. All hubs shall have an ANSI Class FN2 shrink fit on the shafts, unless otherwise specified. Assembly shall be accomplished by heating the hub, cooling the shaft and moving the parts to correct position without force. The use of liquid nitrogen for cooling is prohibited. However, use of dry ice or temperature controlled flow of cold oxygen gas vapor from a separate liquid oxygen tank with gas flowing within the shaft bore, or placing the element in a chilled vapor filled box, are acceptable.

10. Keys and Keyways

- A. Keys and keyways shall conform to the dimensions of ANSI B17.1, Keys and Key seats, for square and rectangular parallel keys. Unless otherwise specified, keys shall fit key seats with an ANSI B4.1 Class FN1 fit on the sides (tangentially) and an LC-3 fit top and bottom (radially).
- B. Unless otherwise specified on the Contract Drawings, keys shall be ASTM A668 Class K and shall have a Charpy V-notch toughness of 15 Ft-Lbs at 40°F and shall have a maximum surface finish of 63 micro-inches.

11. Machinery Shims

- A. Where shown on the drawings, all machinery shims required for leveling and alignment of equipment shall be steel, neatly trimmed to the dimensions of the assembled parts and drilled for all bolts that pass through the shims.
- B. Sufficient thickness shall be furnished to secure 1/64 inch variations of the shim allowance plus one shim equal to the full allowance.
- C. Shims 1/2" thick or less shall be Stainless Steel ASTM A240 Type 316/304.
- D. Shims shall be provided without bolt holes and shall be drilled and reamed in the field to the same fit as the other connected components. Shims greater than 1/2 inch shall include one solid plate of thickness equal to 1/2 inch less than total shim thickness.

- E. Shims shall be shown and fully dimensioned and detailed on the shop drawings. Shims with open side or U-shaped holes for bolts will not be permitted. No shims shall have less than two holes for bolts.
- F. The use of peel able surface bonded laminated shims will be permitted as approved in writing by the Engineer. Plastic or other non-metallic shims will not be permitted.

12. Fits and Finishes

- A. Fits and surface finishes for machinery parts shall be in accordance with ANSI B4.1, Preferred Limits and Fits for Cylindrical Parts and ANSI B46.1, Surface Texture. Surface finishes are given as the roughness height in micro inches; if additional limits are required for waviness and lay, they will be specified by the Engineer. Fits for cylindrical parts shall also apply to the major dimensions of non-cylindrical parts.

13. Coatings

- A. Rust-inhibiting coatings for temporary protection of machined surfaces shall be as manufactured by one of the following companies, or approved equal:
 - 1. E.F. Houghton & Company, Valley Forge, PA; RustVeto344
 - 2. Cosomoline 1058, Sanchez, Inc. Chicago, IL; No-Ox-Id "A", Special "X"
 - 3. A.W. Chesterton Company, Stoneham, MA; Heavy-Duty Rust Guard
 - 4. Texaco, Houston, TX; Metal Protective Oil L.

14. Galvanizing

- A. Steel to be galvanized shall be indicated on the Contract Drawings and shall be hot dip galvanized according to the applicable provisions of AASHTO M111 (ASTM A123). The Contractor shall detail on the Shop Drawings drain and vent holes and any other required modifications.

15. Welding

- A. All welds shall be as indicated on the Contract Drawings.
- B. Welds shall be made and tested in accordance with section 505.04 of the IDOT Standard Specifications. The contractor shall engage the services of an independent welding inspector that reports directory to the Department. All failed welds shall be redone and tested until all is done and accepted by the engineer.
- C. All welding shall be accomplished within the controlled environment of a fabrication shop. Any field welding procedures submitted by the Contractor shall be subject to the approval of the Engineer.

16. Grout

Non-shrink cement grout shall be certified to meet the requirements of ASTM C 1107 for a grade B grout in a fluid State as follows:

- A. Be packed in bags that do not vary by more than four percent from the weight Stated on the bag.
- B. Have mixing instructions and expiration date clearly marked on each bag.
- C. Not contain gas generating air release agents such as aluminum powder for shrinkage control.
- D. Meet the requirements of ASTM C1107 when tested in a fluid consistency. Fluid consistency shall be defined as 30 second flow by ASTM C 939. The requirement of ASTM C 939 shall be passed at 70 degrees Fahrenheit plus or minus 5 degrees Fahrenheit (grout temperature) after 30 minutes without separation or segregation of the aggregates.
- E. 2500 psi compressive strength at one day, 4500 psi at three days, and 6,000 psi compressive strength at 28 days.
- F. Be warranted by the manufacturer. The warranty shall be free of any disclaimers. The manufacturer shall be represented by a tech-service representative who shall be present at the construction site to advise Contractor.
- G. Maintain fluid of flow able consistency with slight agitation or stirring for 45 minutes after mixing per ASTM C 939.
- H. Volume expansion of grout shall be less than 0.07 percent at 28 days when measured in accordance with ASTM C 1090. Grout shall gradually expand until fully cured, and shall not undergo shrinkage of any kind, including reversal of immediate expansion, at any time during the cure process. At no time shall the expansion be less than that measured in the initial hardened State. Measure expansion at 1, 3, 7, 14, and 28 days.

17. Epoxy Grout

Epoxy grout used for anchor bolt installation shall be creep resistant grout meeting the provisions of Section 914.03 of the Standard Specifications and the following additional minimum requirements:

- A. Grout shall be three-part grout consisting of epoxy resin, curing agent and aggregate compound.
- B. Compressive strength per ASTM C 579 shall be 18,000 psi at seven days.
- C. Flexural strength per ASTM C 580 shall be 2,300 psi.

- D. Tensile strength per ASTM C 307 shall be 2,300 psi.
- E. Flexural Modulus shall be 2,300,000 psi.
- F. Compressive Modulus per ASTM D 695 shall be 8,700,000.
- G. Slant shear strength per AASHTO T237 shall be 8,200 psi.
- H. Bond strength to concrete shall be greater than Portland cement concrete per ACI 503
- I. Density per ASTM C 695 shall be 127 pcf.
- J. Heat deflection temperature per ASTM D 648 shall be 160 degrees Fahrenheit.
- K. Linear shrinkage per ASTM D 1566 shall be less than 0.0003 inch.

18. NDT Testing

- A. Magnetic Particle Inspection.
 - 1. Magnetic particle inspection shall be performed according to AWS D1.5.
 - 2. All parts with cracks detected by the inspection shall be rejected and reported to the Engineer for disposition or repair procedures.
- B. Dye Penetrant Inspection.
 - 1. Liquid dye penetrant inspection shall be performed according to AWS D1.5.
 - 2. All parts with cracks detected by the inspection shall be rejected and reported to the Engineer for disposition or repair procedures.
 - 3. All other acceptance criteria shall be in accordance with the requirements of AWS D1.5.
- C. Ultrasonic Inspection.
 - 1. Ultrasonic inspection shall be performed according to AWS D1.5.
 - 2. Discontinuities extending to the surface of the part, regardless of size, shall be rejected and reported to the Engineer for disposition or repair procedures.
 - 3. All other acceptance criteria shall be in accordance with the requirements of AWS D1.5.
- D. Radiographic Inspection.
 - 1. Radiographic inspection shall be performed according to AWS D1.5.

2. Discontinuities extending to the surface of the part, regardless of size, shall be rejected and reported to the Engineer for disposition or repair procedures.
3. All other acceptance criteria shall be in accordance with the requirements of AWS D1.5.

19. Machining

- A. All surfaces with a surface finish symbol shown in the Plans shall be machine finished.
- B. All surfaces requiring machining shall be finished in accordance with AASHTO Movable Bridge Specification and as specified herein.
- C. Any surface finish, dimensional accuracy, or other machining requirement for the machined parts, more stringent than those specified in the Plans that Contractor deems necessary for his own purposes and benefit to fabricate, assemble, align, erect, and install the parts in accordance with the Plans and these Supplementary Specifications shall be provided by Contractor at no additional cost to the State.
- D. Parts in contact with other parts or with supports shall be machined to provide even, true bearings. Surfaces in sliding or rotating contact with other surfaces shall be finished true to dimensions and in accordance with Article 2.5.17 of AASHTO Standard Specifications for Movable Highway Bridges.
- E. Lay for sliding surfaces shall be in the direction of sliding.
- F. All journals on shafts and pins shall be accurately turned, ground, and polished with no trace of tool marks or scratches on the journal surface or adjoining shoulder fillets.
- G. Machining flaws shall be repaired subject to approval by the Engineer of proposed repair method and resulting repair.
- H. All grease grooves shall be machine-cut and smooth.

20. Assembly

- A. Match Marking: connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match marked, and a diagram showing such marks shall be furnished to the Inspector and Engineer prior to disassembly.
- B. Surfaces of metal that will be in contact when shop assembled shall not be painted. These surfaces shall be thoroughly cleaned of rust, loose mill scale, dirt, oil or grease and all other foreign substances.

- C. Assembled parts shall be taken apart if necessary for the removal of burrs and shavings produced by the reaming operation.
- D. Upon completion of assembly, parts that are to be disassembled, or left in the partially assembled condition, shall be coated with an approved rust inhibiting compound. Remove the rust inhibitor from bearing surfaces is to be removed before final assembly.
- E. The parts shall be free from twists, bends or other deformations.
- F. Each assembly, including alignment, accuracy of holes, and workmanship, shall be approved by the Engineer before reaming is commenced.
- G. The approval by the Engineer of any shop assembly method shall in no way reduce the responsibility of Contractor to construct the components as required by the Plans and Supplementary Specifications.

21. Submittals

The Contractor shall submit the following procedures for acceptance by the Engineer:

- A. Locating and drilling all holes and providing specified fit between holes and bolts.
- B. Method of removing and protecting bearing caps and thrust collars for NDT testing.
- C. Method of cleaning of rack and all open gearing
- D. Method of Demolition and Disposal of mechanical items and equipment .
- E. Method of match marking existing components to be removed and reinstalled so that they are reinstalled in their original position and orientation.
- F. Method of dismantling the existing machinery, and installation of new machinery.
- G. Set up and shop testing of mechanical assemblies.
- H. Method of securing the bascule spans in the open position.
- I. Method of removal existing and installation of trunnion shaft bearing anchor bolts.
- J. Method of final machining and installation of thrust collars.
- K. Method of Strain Gage testing and counterweight modification
 - 1. The Contractor shall submit the required shop drawings for machinery items to the Engineer for review. The schedule of shop drawing submission shall meet all IDOT requirements stated elsewhere in this document..

2. The Contractor shall submit to the Engineer for his approval six (6) prints of all shop drawings. In case of correction or rejection, the Contractor shall resubmit six (6) prints of shop drawings until drawings are approved. No materials shall be ordered prior to the approval of the shop drawings; and no work shall be done until the shop drawings have been approved. After approval of the shop drawings, the Contractor shall obtain the proper "Approved" stamps on his shop drawings and shall supply the Engineer with six prints of the approved shop drawings.

22. Lubrication

Standard grease fittings for a pressure system of lubrication shall be provided for all bearings, and surfaces requiring external lubrication. Giant button head fittings shall be used except otherwise specified herein or directed by the Engineer. Pressure fittings shall be rated at a minimum of 10,000 psi. Fittings shall contain a stainless steel check valve that will receive grease and close against back pressure.

Fittings shall be connected directly into the bushings by 1/4-inch minimum size, brass, heavy wall, and threaded pipe and threaded fittings.

Pipe extensions shall be provided to facilitate access for lubrication but shall be kept as short as practical and shall be rigidly supported at the fittings and at intermediate points as approved by the Engineer.

Immediately after the completion of fabrication, all grease fittings, including pipe and pipe fittings, shall be plugged until components are installed and regular lubrication is started. The plugs shall then be replaced with the proper grease fittings.

The Contractor shall furnish lubrication charts and the component manufacturer's lubrication literature for every machinery component that requires lubrication.

The charts shall consist of:

A schematic diagram of all machinery showing the location of all lubrication fittings and other points of mechanical and electrical equipment that require lubrication of any kind. This diagram shall indicate the type of lubrication to be used at each point, the method of application at each point and the frequency of lubrication at each point.

A table chart listing each machinery component that requires lubrication, the minimum frequency of inspection, and the minimum lubrication frequency, the minimum lubrication change frequency instructions, standards, guidelines and a history of most recent service.

The chart shall be protected and mounted as directed by the Engineer.

23. Painting

- A. The Contractor shall apply paint as specified in the Special Provision for Cleaning and Painting contained in the Contract Documents.
- B. All new and reused span drive machinery components shall be field painted Federal Green after final assembly and alignment unless otherwise indicated in the Specifications or Contract Drawings.

- C. Paint shall not be applied to any bronze components of the span drive machinery or to bearing surfaces of machinery.
- D. Paint shall not be applied to the tooth contact surfaces of the racks or pinions.
- E. The following span drive components shall be painted Federal Safety Orange:
 - 1. Floating shafts
 - 2. All couplings
 - 3. Non-friction surfaces of the machinery and brake wheels

Shop Drawings

The Contractor shall prepare shop drawings for the following mechanical components in accordance with the requirements for shop drawings specified in IDOT Standard Specifications, and the requirements herein.

- 1. The Contractor shall prepare shop drawings for the following mechanical components in accordance with the drafting requirements of the State of Illinois:
 - A. Operating machinery components including Main Motors, Motor Brakes and Machinery Brakes.
 - B. Center locks
 - C. Trunnion Bearing Bolts and anchor bolts
 - D. Thrust collar Assemblies
 - E. Live Load Shoe Bearings
 - F. Traffic Gates Assembly and components
 - G. Barrier Gate Assembly and components
 - H. Sump Pump components
 - I. Lubrication system
 - J. Counterweight balance/modification
- 2. Shop drawings shall show all parts completely detailed and dimensioned. Reproduction of the Contract Drawings shall not be used as base sheets for assembly or erection drawings.
- 3. Materials and material specifications shall be stated for each part. Where ASTM or any other standard specifications are used, the applicable numbers of such specifications shall be given.

4. Required finish machining shall be shown including grade of finish in accordance with ANSI B46.1, Surface Texture, and dimensional tolerances and allowances for specific fits in accordance with ANSI B4.1, Preferred Limits and Fits for Cylindrical Parts for components dimensioned in U.S. customary units. Precision components dimensioned in metric units shall only be provided with the concurrence of the Engineer.
5. The fits and finishes shall conform to the requirements of the AASHTO Standard Specifications for Movable Bridges, and to any additional requirements indicated on the Contract Drawings or in this Specification.
6. Shop drawings shall show all external dimensions and clearances necessary for installation and operation of all new bridge machinery.
7. The Contractor shall furnish complete assembly drawings or diagrams showing each part contained therein and the manufacturer's part number assigned to each part. The drawings or diagrams shall be sufficient to enable complete disassembly and reassembly of the assemblies described herein. In the event that any part is modified in any manner from the way it is described or delivered by its original manufacturer, the Contractor shall furnish a drawing which details each modification and the part shall be assigned a unique part number to assure the furnishing of replacement parts modified in similar fashion.
8. Certified prints of each manufactured assembly shall be furnished. Certified prints are manufacturer's drawing of proprietary products where mounting dimensions, ratings, and any other required properties are shown and manufacturer certifies their correctness for this specific project. In addition to identifying and describing each part, they shall show:
 - A. Dimensions of all principal parts comprising the assembly.
 - B. Certified external dimensions, which affect clearances and are required for installation, including tolerances.
 - C. Capacity and normal operating ratings.
 - D. Recommended lubrication, including location, lubrication fittings and provisions for adding, changing and checking the level of lubricants.
 - E. Inspection openings, seals and vents.
 - F. Details or description of all fasteners required to mount the assembly.
 - G. Gross weight
 - H. Name of the bridge, and location.
 - I. Certified prints shall be signed and dated by an officer of the manufacturing company.

- J. Complete shop bills of materials shall be made for all machinery parts. If the bills are not shown on the shop drawings, prints of the bills shall be furnished for approval in the same manner as specified for the shop drawings.
- K. The computed weight of each piece of machinery shall be stated on the shop drawings upon which it is detailed or billed.
- L. Complete assembly and erection drawings shall be furnished. These drawings shall give part numbers, match marks, and essential dimensions for locating each part or assembled unit with respect to the bridge structure or foundation.
- M. Each shop drawing shall be given a suitable title to describe the assembly or parts detailed thereon, and the complete project name, contract number and structure number 099-9904 shall identify each drawing.
- N. Lubrication charts shall be prepared and submitted as shop drawings.
- O. It is the Contractor's responsibility to manufacture and install stable functioning machinery. Review and approval of shop drawings by the Engineer does not relieve the Contractor of this responsibility.

Operations and Maintenance Manuals and Drawing Books.

The contractor shall prepare and submit an Operation and Maintenance Manual (OIM) for the electrical and mechanical rehabilitation. Both hard copies and electronic color pdf copies shall be submitted. Refer to details and contents of the Electrical/Controls OIM manuals in the electrical section of these specifications.

1. General Requirements for Manuals

- A. Operating and maintenance manuals giving complete instructions relative to assembly, installation, operation, adjustment, lubrication, maintenance, disassembly and carrying complete parts list shall be furnished by the Contractor for every item of equipment furnished by the Contractor.
- B. Manuals may include manufacturer's standard publications provided that they comply with specified requirements relative to quantity and quality of information and data, and the additional requirements stated herein these Specifications.
- C. Operating and maintenance manuals shall each be individually and separately bound volumes; not combined.
- D. All printed matter, data, drawings, etc., shall be accurate, distinct and clearly and easily legible. Illustrations shall be clear; and printed matter, including dimensions and lettering on drawings, shall be legible. If reduced drawings are incorporated to manuals, the original lines and letters shall be darkened as necessary to retain their legibility after reduction. Larger drawings may be folded into manuals to page size.

- E. All printed matter, data, drawings, etc., shall be produced by methods so as to result in permanence and durability; no materials shall be used which will adversely affect this permanence and durability.
- F. All printed matter, data, drawings, etc., shall possess characteristics of clarity, legibility, and capacity so as to be capable of reproduction by microfilm.

2. Content of Manuals.

Manuals shall contain, as a minimum, the following:

- A. Table of contents, in numerical page order.
- B. Index, in alphabetical order.
- C. Manufacturer's literature describing each piece of equipment and giving complete identification including manufacturer's model number and drawing number. A set of descriptive leaflets, bulletins and drawings covering all items of equipment used in the bridge machinery. The catalog number of each piece shall be given, to be used in case it becomes necessary to order replacement parts from the original manufacturer.
- D. Operation instructions, including step-by-step preparation for starting, operation, shutdown, and draining of all machinery components. Operation instructions shall note all precautions required for correct and safe operation.
- E. Sequence of operation and how each component and interlock effects the operation of other components.
- F. Diagrammatic location, function, and tag numbers of each valve used in required piping.
- G. Maintenance and lubrication instructions for the machinery components.
- H. Lubrication schedule indicating method and frequency of lubrication.
- I. Schematic indicating what items should be cleaned and painted on a regular basis.
- J. Complete details and procedures for adjusting all items that may wear.
- K. Anticipation of possible breakdowns and repairs for trouble-shooting.
- L. Manufacturer's parts list of functional components, control diagrams and wiring diagrams where required, giving manufacturer's model number and part number. List shall include split-bearing seals needed for replacement.
- M. Steps for cursory inspection that should be carried out annually.

- N. Steps for in-depth inspection that should be carried out every 2 years.
 - O. List of nearest location suppliers of all components parts, including their addresses.
 - P. Spare parts data as follows:
 - I. Complete list of parts and supplies with sources of supply.
 - II. List of parts and supplies that are either normally furnished at no extra cost with purchase of equipment, or specified herein to be furnished as part of this Contract.
 - Q. Name, address, and telephone number of the manufacturer's representative and Service Company, for each machinery component so that service or spare parts can be readily obtained.
3. Operating Diagrams
- A. As approved by and in the sole discretion and opinion of the Engineer.

MECHANICAL DEMOLITION

1. DESCRIPTION

This work shall consist of furnishing all labor, materials, plants and incidentals required to remove the mechanical components as indicated on the contract drawings and specified herein.

- A. This demolition work shall include, but not be limited to the following operating machinery components:
 - 1. All motor brake, brake wheels, all associated supports and components.
 - 2. All motor brakes, motor bolters, all associated bolts connecting the motor and motor bolsters to the existing support.
 - 3. All main motor pinions.
 - 4. All machinery brake, brake wheels, brake operating cables, sheaves, equalizers, pipes, supports, and all electrical associated components. The demolition shall also include the brake hand levers in machinery rooms. The machinery brake thrusters shall be removed and salvaged.
 - 5. The tie-shaft machinery and all associated gearing, components and supports.
- B. The demolition of all existing barrier gates shall also be included under this Item. The demolition of the barrier gates shall include but not be limited to the following:

1. Removal and disposal of all existing barrier gates and all associated assemblies.
 2. Removal and disposal of all existing foundations and anchor bolts for the barrier gates.
- C. The demolition of all existing traffic gates and all associated components shall also be included under this Item. The demolition of the traffic gates shall include but not be limited to the following:
1. All existing traffic gates and all associated assemblies.
 2. Removal of all existing traffic gate foundations and all anchor bolts.

2. CONSTRUCTION REQUIREMENTS

- A. Demolition and disposal of all machinery equipments and components indicated on the Contract Plans and stated herein shall be in accordance with all local and Federal regulations.
- B. The existing cam limit switches gear set on the existing brake shaft shall be re-used. Contractor shall not damage the cam limit switches during the demolition of the machinery brakes.
- C. Contractor shall perform the demolition carefully not to damage any equipment or components not part of the demolition, which are to remain or salvaged.
- D. Existing machinery components for demolition may contain existing lead-paint. All demolition and disposals shall be in accordance with all Local and Federal regulations.
- E. The existing enclosed machinery components of the tie-shaft machinery may contain lubricating oil and grease. All removals and disposals shall be in accordance with all local and federal regulations.
- F. Any damage to the machinery floor due to the demolition of the tie-shaft machinery supports shall be repaired due to the demolition of the machinery components.
- G. The contractor shall submit a complete demolition plan for all the mechanical work.

3. METHOD OF MEASUREMENT

No separate measurement shall be made for the work under this Item.

4. BASIS OF PAYMENT

The work under this Item will be paid for at the Contract Lump Sum price for **MECHANICAL DEMOLITION.**

OPERATING MACHINERY

2. DESCRIPTION

The work shall consist of furnishing all labor, materials, plants and incidentals required to rehabilitate the operating machinery in accordance with the Plans, Specifications, and the directions of the Engineer.

Work shall include, but not be limited to, the following tasks:

1. Replacement of electric motor assembly, motor pinion and all associated components.
2. Replacement of motor brakes and all associated components.
3. Replacement of machinery brakes and all associated components.
4. Refurbishing pinion bearings and replacement of pinion bearing cap bolts.
5. Complete cleaning of all open gearing and all associated components.
6. Replacement of existing lubrication fittings, associated piping and supports components
7. Painting and lubrication of all existing and new operating machinery components including all machinery support framing.

3. MATERIALS

MAIN MOTOR

The drive motors shall be vector duty motors. They shall be built in strict accordance with NEMA publication MG-1 and designed for use with an IGBT AC closed loop vector control. They shall be 3 phase 60 hertz, with moisture resistance insulation, 50 degree C ambient temperature, and capable of reversing. Motor frame shall be constructed of cast ductile iron conforming to ASTM A874..

- | | |
|---------------------|-----------------|
| 1. Horsepower: | 75 HP |
| 2. Nominal Voltage: | 480 VAC primary |
| 3. Nominal speed: | 530 RPM |
| 4. Duty: | 60 minute |
| 5. Frame size: | 444T |
| 6. Insulation: | HHH |
| 7. Service Factor: | 1.0 |

- B. The motors shall be totally enclosed non-ventilated construction, with re-greaseable ball bearings, moisture resistant insulation and internal space heaters sized by manufacturer.

- C. The motor shall have a special extended shaft as shown on the mechanical contract drawings to accommodate the motor coupling on one end and a rear mounted encoder on the other. A drain hole of not less than 1/2 inch diameter shall be provided at the bottom of the motor.
- D. All winding shall be copper. The motor shall be capable of having a minimum breakdown torque of 275%. Motor must have a speed range of 1000: 1 and be capable of having full torque at zero speed. Motor design shall be low inertia and slip design with a N/O temperature sensor in the windings. Motors must have a minimum construction of 8 poles.
- E. Motor encoder shall be an industrial magneto-resistive type (glass encoder wheels are not acceptable). The encoder shall have a resolution of 1024 ppr with 12 volt DC power and be compatible with the Magnetek vector control drive. Separate terminal box with terminal strip for feedback unit.
- F. The conduit boxes shall be liberally sized and located to avoid interference with the machinery. The conduit boxes shall be sized in accordance with the requirements of the NEMA MG 1-1987 PART 11.
- G. The motors shall be designed and manufactured in the United States of America. All motors must be hand wound and assembled and meet the buy American act.
- H. All motors must be manufactured to the following standards:
 - 1. IEEE Marine Standards No. 45.
- I. Modifications needed to meet the requirements of these specifications are as follows:
 - 1. All aluminum parts - chemical film (MIL-C-5541) and zinc chromate primer (MIL-P- 8595).
 - 2. Cadmium plate shaft and hardware (FED-QQ-P-416).
 - 3. Re-greasable ball bearings.
 - 4. Screens over all openings - 3 x 3 mesh - galvanized (drip-proof protected only).
 - 5. Seal all joints and eye bolt holes.
 - 6. Sealed leads in terminal box (waterproof - TENV and TEFC only).
 - 7. Shaft seals (waterproof - TENV and TEFC only).
 - 8. Removable drain plugs (waterproof - TENV and TEFC only).

9. Final coat of epoxy paint
 10. Corrosion resistant coating - rotor and stator laminations.
 11. Stainless steel nameplate.
 12. Super 'H' insulation. Includes protection against fungus growth per MIL-V-173B.
- J. The motor frame shall be finished with a corrosion-resistant paint or coating. Exposed unpainted metal surfaces shall be of a corrosion-resistant material.
- K. Motor must be designed to operate at carrier frequencies up to 20 kHz.
- L. All motors must be dynamically balanced.
- M. One motor shall be subjected to a full load heat run test and the other to a routine test in accordance with the current requirements of the NEMA MG 1-1987 PART 12, and IEEE STD 112-1984. The data, including that required by the submission section of this specification, shall be certified and submitted to the Engineer on the IEEE forms. The Engineer shall be notified of the time and place of the testing at least three weeks in advance of the testing. The Engineer shall determine if the motors are as specified and in accordance with requirements and if the two motors are substantially identical.
- N. After entire motor, brake and control system installation, the contractor shall perform a speed/current test to demonstrate that the motor functions properly and provides the specified operating characteristics as called out in the testing section of this specification. The data shall be recorded on a chart recorder and include acceleration, deceleration, full speed, reduced speed and creep speed.

AC SPEED SWITCH

For AC speed switch specifications, see electrical specifications.

MOTOR PINION

Motor pinion shall be as shown on contract plans and elsewhere in these special provisions for mechanical items.

- A. The motor pinion shall have a 14-1/2 degree full-depth, involute cut teeth in accordance with the proportions of ANSI/AMGA 201.02.
- B. The motor pinion shall have 17 teeth, 5.6667 pitch diameter, 3 diameter pitch.
- C. The teeth shall be cut from solid rims or blanks. The sides of all pinions shall be furnished and the pitch circle shall be inscribed on both sides not less than 0.02 inch deep with a v-pointed tool. The walking surfaces of all pinion teeth shall be

true to the proper outline, accurately spaced on the true pitch circle, exceptionally smooth, and free from planning or milling cutting ridges. Cutter burrs shall be removed from all edges of the teeth and the top of the edges shall be rounded to a 1/32-inch radius.

- D. All gears shall be cut and mounted to meet the requirements for accuracy of AGMA Standard 390.02, AGMA Gear Classification Manual. The pinion shall conform to AGMA Quality No. 6.
- E. The motor pinion shall be ASTM A668 Class J Forging, SAE 41L40 heat treated (quenched, tempered and stress-relieved). The CVN impact toughness of the pinion in the radial direction of the bar (not the longitudinal direction) shall be 25ft-lbs at 40°F.
- F. The pinion shall have 63 micro-inch surface finish on contacting surfaces of all gear teeth.

COUPLINGS

- A. The couplings connecting the motor brakes to the AC motor speed switch, shall be Jaw In-Shear type LS095, Style 1 with a 5/8" bore, as manufactured by Lovejoy, Inc. or Engineer approved equal.
- B. The coupling retaining ring shall be cast stainless steel.
- C. The couplings shall be provided as a complete assembly from the manufacturer including all Coupling lubricant and its maintenance shall be specified by the manufacturer.
- D. The faces of all couplings shall be machined fitted. The parts of each coupling shall be fitted together and match-marked prior to shipment. Couplings shall be installed on their shafts by the manufacturer of the connecting equipment.

MACHINERY BRAKES

- A. Brakes shall be 35 3/8-inch type SBZ 14.31-900 x 30-ED 501/8 Dual Caliper Disc Brake with an external torque spring.
- B. Brake hubs shall be Type N360-900 x 30. The brake disc shall be fully machined to the dimensions and tolerances required for the application. The hubs and disc shall be fully compatible with the required brake performance and guaranteed by the Contractor.
- C. Brake actuators shall be Eldro type ED 501/8 as manufactured by Bubenzer Bremsen or Engineer approval equal. All requests for substitutions shall be clearly called out and technical data, catalogue information, drawings, cut-away view and maintenance manuals shall be provided with bid proposal.

- D. The brakes shall include but not limited to the following features:
1. Adjustable external torque spring with a maximum torque setting of 20,283 ft-lbs.
 2. Manual hand release lever.
 3. Limit switches for brake release control, set control and manual release control.
 4. Nitride corrosion protecting finish for all steel components.

MOTOR BRAKES

- A. Brakes shall be 13-inch, type EBN 315-121/6 heavy duty rated industrial drum brake with an external torque spring.
- B. Brake wheels shall be supplied with the motor brakes and manufactured from ASTM A732 Grade 5N cast steel with a CVN impact toughness of 25 ft-lbs at 40°F. The wheels shall be fully machined to the dimensions and tolerances required for the application. The wheels shall be fully compatible with the required brake performance and guaranteed by the Contractor.
- C. Brake actuators shall be Eldro type ED 121/6. All requests for substitutions shall be clearly called out and technical data, catalogue information, drawings, cut-away view and maintenance manuals shall be provided with bid proposal.
- D. The brakes shall include, but not limited to the following features:
1. Automatic wear compensation of shoes.
 2. Adjustable external brake torque spring with a maximum torque setting of 1843 ft-lbs.
 3. Manual hand release lever.
 4. Limit switches for brake release control, set control and manual release control.
 5. Nitride corrosion protection finish for all steel components.

PINION BEARINGS

The pinion bearing cap bolts and nuts shall be replaced in-kind.

The Contractor shall prepare a detailed procedure and drawings for removal and replacement of the main pinion bearings for approval by the Engineer.

OPERATING MACHINERY SUPPORTS

- A. The new operating machinery supports for the main motor, motor brakes and the AC Speed Switch shall be steel weldments fabricated according to the Contract Plans.
- B. The new operating machinery supports shall be tested according to the welding requirements specified herein prior to installation.

LUBRICATION FITINGS AND PIPINGS

- A. Standard lubrication fittings and associated piping for pressure system of the lubrication shall be provided for all components and surfaces requiring external lubrication. Giant button head fittings shall be used except where otherwise specified here-in or as directed by the engineer.
- B. Pressure fittings shall be rated at a minimum of 10,000psi.
- C. Fittings shall contain a stainless steel check valve that will receive grease and close against back pressure.
- D. Fittings and piping shall conform to the requirements as previously described within these specifications.

4. CONSTRUCTION REQUIREMENTS

General

- A. All requests for submission shall be clearly called out and technical data, catalog information, drawings and the maintenance manuals shall be provided with the bid proposal.
- B. Sufficient notice shall be given to the Engineer at the beginning of work at foundries, forge and machine shops so that an inspection may be arranged. It shall be the responsibility of the Contractor to provide free access to all premises where the preparation, manufacture or assembly is conducted.
- C. Such inspections are to facilitate work and help avoid errors, but such inspections do not relieve the Contractor of his obligation to assure compliance to Plans and Specifications, nor do these inspections relieve him of his obligation to replace defective materials and workmanship.

Motor Pinion

- A. The Contractor shall provide a 63 micro-inch surface finish on contacting surfaces of all gear teeth.
- B. The motor pinion shall have an FN2 fit with the custom motor shaft.
- C. Contractor shall furnish new cap plate for motor pinion. Cap plates shall be second to the motor pinion by set screws.
- D. The contractor shall furnish and install new keys for the motor pinions.
- E. The motor, pinion, cap motors and set screws shall be mounted in the machine shop.

Couplings

- A. The couplings shall be installed on shafts and aligned within the coupling manufacturer's recommendation for gap, parallel offset and angular offset.

Motor Brakes

- A. Brake wheels shall be provided with keys. Keys shall be sized to fit new brake wheel and the new motor shaft. Key dimensions shall be verified in the field before machining of the brake wheel and key. Keys shall conform to ASME/ANSI B17. 1
- B. All brakes shall be installed according to the manufacturer's recommendations.
- C. The brakes shall be adjusted to the torque settings specified on the Plans.
- D. The new brake support dimensions shall be verified by the contractor prior to the fabrication of supports.
- E. The locations for the new brake supports connections to the existing machinery support shall be as shown on the contract plans.
- F. The new shims are to be installed to aid in the positioning and the brakes to the proper height.
- G. Shims shall conform to the requirements as previously described within these specifications.

Machinery Brakes

- A. The brakes shall be adjusted to the torque settings specified on the Plans.
- B. All brakes shall be installed according to the manufacturer's recommendations.
- C. The contractor shall remove the existing cam limit switch gear set on the existing brake shafts before brake installation. The cam limit switch gear set shall be cleaned completely with solvents, lubricated and re-installed.
- D. Cam limit switch gear set shall be reinstalled after cleaning and brake installation.
- E. Brake hubs and discs shall be provided with keys. Keys shall be sized to fit new brake wheel and the new motor shaft. Key dimensions shall be verified in the field before machining of the brake wheel and key. Keys shall conform to ASME/ANSI B17. 1
- F. All new brake support dimensions shall be verified by the Contractor prior to fabrication.
- G. The contractor shall cut the brake support plates to fit the existing Cam Limit Switch supports at locations where applicable. The contractor shall cut the existing grating to fit the brake support at each location.

- H. Connection of the new brake support to the existing machinery frame shall conform to high strength ASTM A 325 bolts. Connection of the brake to the new brake support shall be high strength turned bolts conforming to ASTM A 490.
- I. The new machinery support shall be installed as shown on the Plans. The contractor shall notify the engineer of any conflict during connection of the new machinery supports and the existing machinery frames.
- J. The new shims are to be installed to aid in the positioning and the brakes to the proper height.
- K. Shims shall conform to the requirements as previously described within these specifications.
- L. Contractor shall cut the brake support to fit the brake disc.

Pinion Bearings

- A. The pinion bearings, associated bearing blocks and cap bolts are corroded at several locations. The Contractor shall disassemble each pinion bearing cap. The bearing blocks shall be match marked and sent to an approved machine shop for complete cleaning and restoration.
- B. Cleaning of the bearing block outer surfaces shall be cleaned to bare metal.
- C. The bore bushings shall be cleaned and inspected.
- D. Lubrication piping and fittings shall be replaced in-kind.
- E. The Contractor shall prime and paint the non-contact surfaces. New bearing liners (shims) and new turned bolts shall be replaced in-kind.
- F. The Contractor shall re-install align and adjust the pinion bearings at each match marked location.
- G. All shims required shall be furnished to align the pinion bearings.

Cleaning of Open Gearing

All surfaces shall be cleaned of all dirt, rust, scale, grease and other foreign matter first with solvents and then by cleaning, wire brushing or other approved means prior to lubrication.

- A. Contractor shall completely clean all open gearing teeth surfaces to bare metal. The cleaning shall also include the racks, tooth surfaces and the sides of all gears and other areas as directed by the Engineer. Cleaning shall initially be done with approved solvents and brushes.

- B. The tooth surfaces shall then be restored by hand grinding and hand polishing to a surface finish of 63 micro-inch. The contractor shall then re-apply an approved lubricant to the surfaces, when polishing and restoration surfaces work has been approved and accepted by the Engineer.
- C. The procedure to restore the open gear tooth surfaces shall be submitted to the Engineer for approval.

5. METHOD OF MEASUREMENT

Payment of this Item shall be made on a Lump Sum Basis.

6. BASIS OF PAYMENT

The contractor shall submit to the Engineer a detailed breakdown of costs under this Item. The Engineer shall evaluate this breakdown and the basis of payment be made in the following manner:

- A. Upon completion and acceptance by the Department of shop fabrication, inspection and testing as well as delivery of materials to site, the Contractor will be paid 30%
- B. Upon completion and acceptance by the Department of al disassembly, refurbishing, installation, inspection and testing of all Operating Machinery Items, the Contractor will be paid 20% of the bid price for the Item.
- C. Upon Completion and final acceptance by the Department of the Installation and field testing, the Contractor will by Paid 30% of the bid price for the Item.
- D. Upon completion, acceptance and final submittal of the Operation and Maintenance Manual, training of Maintenance personnel, the Contractor will be paid the remaining 20% of the bid price for this Item.

The lump sump price for the Item, "**OPERATING MACHINERY**" shall include the cost of furnishing all labor, materials, spare parts, plant, testing adjusting and equipment required including all necessary incidentals for the work herein described and as shown on the Contract Plans for complete Installation.

Progress payment for satisfactory work shall be in accordance with Standard Specification, IDOT standard payment practices and the direction of the Engineer.

REPLACEMENT OF CENTER LOCKS

6. DESCRIPTION

The work under this item shall consist of removal and disposal of all existing center lock components and associated electrical components furnishing, installation aligning, adjusting, testing and painting of new center locks. The center lock components to be removed shall include but not limited to the following:

- A. All existing lock bars, guides, socket assemblies and all associated components.
- B. All existing lock bar cranks, actuating linkages assemblies and associated components
- C. All existing lock machinery supports
- D. All existing limit switch assemblies
- E. All existing manual drive mechanisms and associated components
- F. All existing spur gears, reducer, shaft and keys
- G. All existing transverse line shafts, associated bearings and couplings
- H. Electric motors, brakes and all associated bearings and couplings
- I. All existing lubrication lines and associated components

The new center locks shall include but not be limited to:

- G. Furnishing and Installing New lock bar operator and all associated components.
- H. Furnishing and Installing New lock bars.
- I. Furnishing and Installing New lock bar guides and receivers.
- J. Furnishing and Installing New manual operating system and all associated components.
- K. Furnishing and Installing New lubrication system.
- L. Furnishing and Installing New manual operation mechanism.

Also included is the installation and connection of the lubrication lines from the roadway to the lock bar guides and receivers.

All mechanical work must be planned and coordinated with electrical and structural work as well as closures and restrictions to vehicular and navigational traffic.

7. MATERIALS

BAR OPERATOR

- D. Each operator system shall include a mechanical bar actuator that moves the 5-inch x 9 inch lock bar through a bar guide, situated on one leaf tip, and into a receiver on the other leaf tip. The gearing shall consist of two reductions using heat-treated, alloy steel helical gears on shafts supported by anti-friction bearings.
- E. Each operator shall be driven by a high starting torque, induction type, 5HP, 1800RPM, 3-phase, 60 Hertz, 240/480 volts, NEMA design D, frame B145TDZ, TENV electric motor having a 15 minute duty rating and equipped with a 3 ft-lb marine duty brake with manual release and safety interlock switch. The motor shall be totally enclosed, non-ventilated, equipped with ball bearings and designed especially for outdoor applications subjected to adverse weather conditions. Strip heaters shall be installed in the motor housing.
- F. Travel of the lock bars in each direction shall be governed by a two pole, snap action limit switch that provides two normally open and two normally closed contacts for each length of travel. The lock bar shall take approximately 21 seconds to complete its 1-inch stroke and the operator shall be capable of delivering a thrust of 8800 pounds to the lock bar 50% stall torque of the motor. The housing containing the limit switches shall be equipped with strip heaters.

Lock Bars

The 5-inch x9 inch lock bar shall be ASTM A668 Class L, quenched and tempered and stress relieved forging. A hinged joint shall connect the lock bar to the actuator.

Guides and Receivers

The lock bar guides and receivers shall be energy absorbing type, which incorporates the span alignment guide on the guides and receivers such as Earle "cushionloks" type as manufactured by Steward Machine Co., Inc. or an approved equal.

Each guide and receiver shall have high strength bronze wear shoes supported by a combination of stiff springs that permit some vertical movement of the shoes. When the lock bar is inserted into the guide and/or receiver it shall cause the shoe to depress the strings slightly resulting in a preloaded condition that will ensure continuous firm contact between the lock bars and the shoes.

The selection and design of the system shall be such that the relationship of the minimum and maximum stresses is correct for infinite fatigue life of the energy absorbing spring system. Adjustment of the pre-load between the shoes and the lock bar shall be possible without disassembly of the guides or receivers.

Manual Operators Assembly

The center lock system shall have a manual drive connected through a series of the horizontal and vertical shafts to the road way. Each system shall be installed with movable hand crank as shown in the contract plans.

Limit switches indicating the limits of bar travel shall be provided. Additional limit switches that disengages the main electrical system when the removable key assembly is inserted into the manual drive assembly at the roadway shall be provided.

The contractor shall furnish and install pulleys and rope system as shown on the contract plans to release the brake during manual operation of the span locks. The brakes shall be returned to their normal position after the manual operation and the closing of the hatch. The shop drawings shall detail the size of the pulleys and the rope system arrangement as shown on the contract plans.

8. CONSTRUCTION REQUIREMENTS

Removal of Existing Span Locks

The contractor shall remove and discard all center lock machinery: including but not limited to drive motor, speed reducer, shafts gears, clutches, connecting rods, links, rod guides, lock bars, lock bar guides and receivers and all mounting hardware. Before any work is undertaken on the center lock systems, submit a detailed plan to the engineer for the removal of the existing center lock and installation of the new center locks.

The contractor shall at any time after removal of the existing center locks the bridge is opened to the passage of vehicular traffic; provide temporary span locks at the leaf tips.

Installation, alignment and adjustment of the span lock systems shall all be made only under the supervision of personnel who are experienced and qualified with previous experience in the installation and adjustment of moveable bridges mechanical machinery. The span lock equipment shall be installed, aligned and adjusted by competent millwrights skilled in the type of work involved, provide all necessary measuring, alignment and leveling instruments as may be required.

The contractor shall shop assemble and inspect all the span lock machinery to assure correct fits and assembled dimensions as required by the contract documents. Any components requiring disassembly for installation shall be match marked to enable proper assembly on the bridge leaves.

Upon completion of the span lock systems, submit a testing procedure and schedule to the engineer as outlined in the Bridge Machinery-General.

The tests shall demonstrate the machinery is in correct working order, in full compliance with the contract documents, general and special provisions. Correct, adjust or replace as necessary any irregular operation, evidence of distress, improper functioning, defective or inadequate components revealed during the test, before final acceptance, without additional cost to the department.

9. METHOD OF MEASUREMENT

The department will measure center lock systems, completed in accordance to the contract and accepted as a single complete unit of work.

10. BASIS OF PAYMENT

The work under this Item will be paid for at Contract unit price each for **REPLACEMENT OF CENTER LOCKS**.

NDT TESTING

1. DESCRIPTION

This work shall consist of furnishing all labor, materials, equipment and incidentals required to perform the non-destructive testing (NDT) of the trunnion shafts at all locations.

The work shall include but not be limited to:

Providing access to the trunnion shaft transition fillet area.

Performing Visual examination of all journal ends.

Performing Wet fluorescent magnetic particle inspection of all transitional fillet regions of each trunnion shafts.

2. MATERIALS

As specified in this special provisions.

3. CONSTRUCTION REQUIREMENTS

- A. The contractor shall provide all labor, tools and all equipment necessary to provide complete access to all (16) sixteen transitional fillet regions of all eight (8) bascule trunnion shafts for NDT testing.
- B. Magnetic particle Inspection of all (16) sixteen transitional fillet regions of the (8) eight bascule trunnions, shall be performed in accordance with ASTM Standard E709-08 and AWS D-1.5.
- C. Magnetic particle examinations shall be performed by personnel qualified in accordance with SNT-TC-1A as Level III, or Level II working under the direct supervision of a Level III technician. The testing company shall be Wiss, Janney, Elster Associates or an approved testing company.
- D. The Magnetic Particle Testing shall only be performed after the surfaces of all transitional fillet areas are cleaned. The proposed cleaning procedure and materials shall be submitted to the Engineer for review and approval prior to beginning work.
- E. With the Engineers approval, the contractor may have the option using Dye Penetrant testing at areas with limited accessibility.
- F. The Contractor shall temporarily remove bearing caps and the split rings collars at all locations. Removal of the bearing caps will allow access to the upper 180° of the journals.
- G. "In the event that remedial work is needed for the trunnion shafts as a result of the NDT testing, the Engineer will issue design plans for this additional work within three (3) weeks and the Contractor will be paid for this work under Article 109.04 of the Standard Specifications as approved by the Engineer."

The Contractor shall make provision for accessing the other 180° half of the journals when the bascule span is raised for construction. The trunnion shaft bearings shall be temporarily moved away from the fillet area for access.

The procedure for removal of all bridge components to access the fillet transition area shall be submitted to the engineer for approval.

Provisions shall be made to protect the fillet areas once the collars are removed and during the entire duration of the non-destructive testing process. Once the transitional fillet regions of the trunnion journals are thoroughly cleaned, each transitional fillet region will be inspected using the wet fluorescent magnetic particle method.

Contractor shall make available a source of electric power for the yoke and black light needed for the Magnetic Particle Testing. The non-destructive testing shall be performed under a dark condition for the black light needed for the non destructive testing.

Magnetic fields for the detection of transverse cracks shall be produced with an articulated A.C. yoke.

The Inspection medium shall consist of wet fluorescent particles in petroleum based color and shall be, applied while the magnetic field is energized.

Visual examination of journal ends shall be performed when the journals are exposed for magnetic particle examination.

The inspection shall be documented accurately and shall fully evaluate any surface or near surface cracks or discontinuities that may be present within the fillet region.

The contractor shall submit to the engineer a full detailed report of the Magnetic Particle Testing and findings. The report shall include a detailed condition assessment of each fillet region of the trunnion journals. The report shall include a brief condition assessment of each journal end. The report shall include a table that correlates the ultrasonic examinations performed by Wiss, Janney, Elstner Associates, Inc. (WJE) in November 2008. The Department will make the report available to the contractor.

4. METHOD OF MEASUREMENT

No separate measurement shall be made for this ITEM.

5. BASIS OF PAYMENT

The work under this item will be paid for at the contract lump sum price for **Non Destructive Testing**, as specified herein.

REPLACEMENT OF TRUNNION THRUST COLLARS

1. DESCRIPTION

This work shall consist of furnishing all labor, materials, plants and incidentals required to replace all trunnion thrust collar assemblies, as indicated on the Contract Plans and as directed by the Engineer

This work shall include but not be limited to removing existing, furnishing and installing the following new thrust collar components:

- A. All trunnion thrust collar caps, bases and eye bolts.
- B. All thrust collar turned bolts.
- C. All trunnion bearing cover plates with associated steel rings.

2. MATERIALS

Material for all trunnion thrust collar assemblies and all associated components shall be as indicated on the Contract Plans.

3. CONSTRUCTION REQUIREMENTS

1. Existing thrust collars shall be removed prior to Non Destructive Testing (NDT)
2. Thrust collars are for alignment of the bascule span as it is raised or lowered. Removal of existing collars shall be done only when bridge is "tied up" in the raised position for construction.
3. The bascule span shall not be operated when any of the existing thrust collars are removed.
4. The contractor shall submit procedure to disassemble existing thrust collars and the installation of new thrust collar assemblies.
5. Contractor shall only begin the installation of new thrust collars, upon receiving notification to proceed from the engineer.
6. The contractor shall begin the installation of new thrust collar assemblies only after all optional work has been completed.
7. The contractor shall install and align all thrust collar assemblies after all optional work items are performed if directed by the engineer.
8. The contractor shall precision measure each trunnion shaft location prior to final machining of the new thrust collars. Tolerance between the existing polished trunnion shaft diameter and the thrust collars shall meet the requirement for LC6 fit.

4. METHOD OF MEASUREMENT

Replacement of the existing trunnion thrust collar assemblies shall be measured for payment by complete replacement of each assembly, and aligned per Contract Plans.

5. BASIS OF PAYMENT

The work under this Item will be paid for at Contract unit price for each **REPLACEMENT OF TRUNNION THRUST COLLAR ASSEMBLIES.**

REPLACEMENT OF TRUNNION BEARING CAP AND ANCHOR BOLTS

1. DESCRIPTION

This work shall consist of furnishing all labor, materials, plants and incidentals required to replace all existing trunnion bearing cap bolts and anchor bolts.

This work shall include, but not be limited to the following:

- A. Removal of existing, furnishing and installing new trunnion bearing cap turned bolts.
- B. Removal of existing, furnishing and installing new trunnion bearing anchor bolts.

2. MATERIALS

The trunnion bearing cap and anchor bolts material shall be as shown on contract documents

3. CONSTRUCTION REQUIREMENTS

Replacement of bearing cap bolts and the anchor bolts shall be done after Non Destructive Testing of each trunnion shaft.

4. METHOD OF MEASUREMENT

No separate measurement shall be made for the work under this Item.

5. BASIS OF PAYMENT

The work under this Item will be paid for at Contract Lump Sum price for **REPLACEMENT OF TRUNNION BEARING BOLTS AND ANCHOR BOLTS**, as indicated on the Plans and as directed by the Engineer.

LIVE LOAD BEARINGS

1. DESCRIPTION

The work shall consist of all labor, materials, tools, equipments necessary to properly replace all existing live load bearings. The work shall include but not be limited to:

- A. Removal of all existing live load shoe casting, all associated shims and fasteners.
- B. Repair damaged grout pads.
- C. Clean and paint all existing pedestals.
- D. Clean and paint all existing pedestal slabs.
- E. Furnish and install new shoe casting with associated shims.
- F. Aligning and adjusting bearings as directed by the engineer

2. MATERIALS

- A. The live load bearing components shall be of the material and finish as shown on the Contract Drawings.
- B. Bolts used for securing the components of the live load bearing shall be structural fit ASTM A325 bolts and shall be of the diameter specified on the Contract Drawings.

3. CONSTRUCTION REQUIREMENTS

The live load bearings shall be sufficiently adjusted when a leaf type feeler gauge, 0.015 inch thick, cannot be inserted at any position between the live load bearing strike plate and live load bearing shoe with the span closed. The closed position shall be defined by elevations on the contract drawings or existing drawings and shall be surveyed by the Contractor.

4. METHOD OF MEASUREMENT

Each bid for LIVE LOAD BEARING shall include the cost of furnishing all labor, materials, machinery, plant, testing, adjusting, cleaning, temporary supports and equipment, temporary operation and maintenance and equipment required including all necessary incidentals for the work herein described, and on the Contract Plans, for a complete installation of the live load bearings, ready for operation at each location.

5. BASIS OF PAYMENT

Each price for the **LIVE LOAD BEARING** shall include all items indicated for this specification, unless otherwise noted. No payment will be made for repair of, or replacement of, damaged material, which was made necessary due to the Contractor's operations.

Shop and field inspection and all necessary shop and field tests required by the State, shall be included in the **LIVE LOAD BEARING** lump sum price bid. No additional payment will be made for any work done by the Contractor as part of the one-year guarantee as specified herein.

SPAN BALANCE

1. DESCRIPTION

This Item shall consist of all labor, materials, tools, equipment required to maintaining the bascule leaves in a balanced condition both temporarily and permanently during certain stages of rehabilitation work and finally placing blocks and/or weights in a permanent position as indicated on the Contract plans.

The bulk of the reconstruction work on the movable bridge shall be carried out while the leaves are in the open position and braced to prevent any movement, as show on the Plans. It is not necessary to maintain the balance of the bridge while the leaves are in such condition. Prior to removing such bracing, the bridge shall be brought back into balance.

2. MATERIALS

The new balance materials furnished under this item shall be adjusted in the counterweight pockets, as shown on the Plans and as directed by the Engineer to properly balance the span in accordance with this specification.

Any additional materials or work required to balance the leaves but not shown on the Contract Drawings or mentioned in the Specifications shall be paid for under this item at no additional cost to IDOT.

New counterweight blocks shall be grey iron casting conforming to ASTM A48, Class 20. They shall be delivered and cleaned off foundry said with fins ground off. The blocks weigh approximately 450 pounds per block. The cost of fabrication and delivery of these blocks to the job site shall be included in this item.

3. CONSTRUCTION REQUIREMENTS

General

- A. Balance calculations shall be prepared prior to fabrication and construction based on the measured balance condition and approved shop drawings and material tests, and shall be submitted to the Engineer for review and approval.
- B. The final distribution for balancing the leaves shall be the Contractor's responsibility, and the Contractor shall make all adjustments and relocations necessary to attain the distribution to the satisfaction of the Engineer. All existing counterweight blocks that are relocated may be reused provided that they are in good condition as determined by the Engineer.
- C. If the Contractor needs more cast iron blocks for the balancing of the bascule bridge during interim phases of construction than are used in the completion of the final bridge balance, the Contractor shall turn any excess blocks over to IDOT upon completion of the work. No additional payment will be made for these additional balancing blocks.
- D. The Contractor shall measure the imbalance moment and determine the location of the leaf center of gravity a minimum of three times:
 1. Initial - Prior to performing any work that would significantly alter the balance of the leaves the contractor shall perform a balance test on each bascule leaf as outlined elsewhere in this Specification. Prior to performing intermediate balance testing, the Contractor shall submit to the Engineer for review and acceptance balance calculations and summary tables based on the initial measured span imbalance and predicted balance change from the deck and machinery replacement.
 2. Intermediate – This balance test shall be performed after the Contractor has added weight to the span as accepted by the Engineer based on the initial span balance test. The primary purpose of this test is to determine the amount of span balance materials to add. After intermediate balance testing, the Contractor shall compute the amount and location of weight adjustments required to achieve the final imbalance specified in this Specification accounting for the deck and machinery replacement and submit the computations to the Engineer for review. After the Engineer's review, the Contractor shall make the approved adjustments.
 3. Final - After balance adjustments and installation of the new deck drive machinery, to determine if the revised imbalance is within the limits specified in this Specification. Leaf operation for final balance testing shall be performed with the new span drive machinery. If the final balance testing indicates that the

revised imbalance is not within acceptable limits, further balance adjustments and balance testing are to be performed until the criteria specified herein are met at no additional cost to IDOT

- E. After acceptance of the bridge by the Engineer as “balanced,” an additional ½ % of the total weight of the counterweight, in EXISTING counterweight blocks shall be provided for future adjustment of the bridge balance. These blocks shall be as required by AASHTO “Standard Specification for Movable Highway Bridges”, 1988 with interims Article 2.1.3. The excess existing blocks shall be delivered and unloaded at a location to be specified by the Engineer.

Submittals

- A. The Contractor shall submit balance calculations as specified herein to the Engineer for review and approval. A Structural Engineer licensed in the State of Illinois shall perform the balance calculations. The quantity and location of balance material required within the counterweight pockets, based on the specified balance requirements and the weight and center of gravity of each bascule leaf shall be computed. These calculations shall be based on weights of approved shop details and material tests for the actual material on each leaf. The balance calculations shall incorporate the distributions of leaf weight in the vertical, horizontal, and transverse directions.
- B. Summary balance tables shall be developed and shown on the shop drawings. Summary tables shall be developed for all phases of the balance and the proposed imbalances. Temporary balance material, if used, shall be accounted for in the summary tables. All summary tables and back-up materials shall be submitted for review. A narrative shall be included with the outline of the proposed phasing, the duration of the imbalance condition, and all other aspects of the work in accordance with the approved construction schedule. This information shall be coordinated with the Contractor’s scheduling requirements and shall be submitted to the Engineer for review. Weights for new work shall be developed on the shop drawings for each component. The balance calculations and summary tables shall be updated by the Contractor throughout construction and be submitted to the Engineer periodically as required to meet the requirements in this Specification. It shall be the Contractor’s responsibility to provide temporary balance material as required to stabilize the movable span during balancing.
- C. Review of the balance calculations, counterweight details, and quantity and location of balance material does not relieve the Contractor from making such changes in the counterweights and balance material as deemed necessary to balance each leaf. All changes shall be submitted for approval.

Procedure

- A. The balance of each leaf of the movable span shall be measured using the dynamic strain gauging technique and by monitoring and recording motor amperage and voltage. The Contractor shall furnish and install all equipment, materials, instruments and labor necessary to determine the imbalance by dynamic strain gauging and by monitoring and

recording motor amperage and voltage. The Contractor shall employ the services of an established testing company experienced in dynamic strain gage measurement of movable bridge imbalance, subject to approval of the Engineer. Such experience shall be demonstrated by identifying a minimum of six movable bridges including at least three trunnion bascule bridges for which the company has provided complete and satisfactory dynamic strain gage measurements and reporting. The measurements shall be made under joint direction of a Structural Engineer and an Electrical or Instrumentation Engineer, each licensed in the State of Illinois who has had hands-on-experience measuring movable span imbalance by the dynamic strain gage method. The testing company shall furnish and install the required strain gages, all cabling and transmission equipment, data acquisition equipment and strip chart recorders and produce fully documented reports detailing the results of the measurements. Acceptable testing companies include Specialty Measurements Incorporated, Pittstown, NJ; Teledyne Engineering Services, Woburn, MA, Wiss, Janney, Elster, Inc of Northbrook, IL and Stafford Bandlow Engineering, Washington Crossing, PA. The approved testing company shall submit the following items to the Engineer for approval:

1. Description of experimental procedure including type and method of installation of strain gage rosettes, method of transmission of low level signals, data acquisition equipment and/or strip chart recorders.
 2. Layout of span drive machinery showing proposed location of strain gages, amplifiers, cable or radio links, data acquisition equipment and all associated cabling.
 3. Details of method of transmission of signals from shafting to data acquisition units.
 4. Elementary wiring diagrams of interconnection of strain gages, amplifiers, data acquisition equipment, and strip chart recorders.
 5. Sample computations of shaft torque from measured strains, span imbalance, curve fitting and basis for friction correction.
- B. Two foil resistance strain gage rosettes shall be affixed to each of the main pinion shafts or intermediate shafts if the pinion shafts are inaccessible, in accordance with the strain gage manufacturer's installation instructions. They shall be preferentially affixed by microspot welding. If adhesively applied, the gages shall be heat cured in accordance with the manufacturer's instructions. They shall be 2-arm 90 degree rosettes mounted such that the grids are oriented at 45 degrees with the shaft axis and the two rosettes shall be affixed "back-to-back", spaced 180 degrees apart circumferentially. The gages shall be connected such that any bending strains in the shafts will be canceled and torsional shearing strains will be measured on each pinion shaft. The areas of the shafts where the gages are to be mounted shall be sufficiently cleaned to remove all contaminants. On each shaft, two rosettes shall be mounted at 180 degrees from each other. The two gages shall be connected such that any direct shear forces in the shafts are neglected and true torsional shear is measured. The strain gage leads on each shaft shall be connected to a 4-arm amplifier. Transmission of signals from the gauges to the data acquisition equipment shall be either through cable links or amplified and then through wireless transmitters. Output leads from each channel of the amplifiers shall be connected to either a computer-based data logger provided with a two-channel strain gage module streaming the amplified data to disk at a minimum 1-kHz sample

rate, or a five channel minimum strip chart recorder with at least ten inch wide chart paper. An inclinometer shall be provided to provide continuous leaf angle to either the data logging equipment or the strip chart recorder. The chart speed shall be step-wise adjustable and shall include a setting of at least 10 inches per minute. The recorder shall be capable of recording data from at least 4 channels if it is equipped with a dedicated event marker or 5 channels if a channel is used to record events. The strains in both pinion shafts shall be recorded simultaneously versus span opening angle during opening and closing to a suitable scale. The readings for all shafts shall be recorded at the same strain scale and the chart speed, if a strip chart recorder is used. At least 3 opening/closing runs shall be made, when the wind speed is less than 5 MPH and the bridge deck is visibly dry. Wind-up torque in the operating machinery shall be released prior to each run as verified by space between the faces of the engaged teeth of main pinions and racks. The strains induced in the shafts shall be numerically converted to torque by applying fundamental stress-strain relationship calculations for each strain plot for both opening and closing. This data shall be processed to give leaf imbalance (kip-feet) versus opening angle, corrected for friction, at each roll center. From them, plots of total span imbalance shall be prepared. Simultaneously, outputs of motor amperage and voltage shall be obtained by electronic recorders with capabilities of capturing signal data of frequencies up to 500 Hz or greater and have an inherent sensitivity of 0.1A and 100 mV.

- C. The Contractor shall submit five copies of a report documenting the results of the initial strain gage measurements. Separate reports are required for each leaf. The reports shall contain the following:
1. Description of experimental procedure and equipment used.
 2. Span drive diagram showing location at which strain gages were attached and all applicable gear ratios.
 3. Photocopies of a sample original strip chart for one complete run of each of the three sets in the case of strip chart recordings or data and chart files in Excel format if recorded by a data logger. They shall be annotated with strain scales, motor amperage, motor voltage, angle of opening, significant ordinates, etc.
 4. Description of relationships and sample calculations for obtaining shaft torque from strains, span imbalance from shaft torque, curve fitting and basis for friction correction.
 5. Plots of the total imbalance and frictional moment, in kip-feet, versus degree of opening during each opening/closing run and fitted balance curves corrected for friction.
 6. Tabulation of imbalance moment at seated position for each leaf/run including the average value for each leaf.
 7. The location of the leaf center of gravity.
- D. After balance adjustment, the Contractor shall submit five copies of the final balance report, similar to the initial report. The reports will be bound between heavy plastic covers. The report shall include an introductory section giving the name of the bridge, the date of the measurements, weather conditions during measurements and any other information requested by the Engineer.

- E. The payment will be full compensation for all material, labor, equipment, tools and incidentals necessary to complete the work. SPAN BALANCE will not be measured for payment but will be paid for at the Contract lump sum price bid for the SPAN BALANCE item. The cost for all preparation, incidentals, adjustments, inspections and testing shall be included in the lump sum price.

Closure of the Bridge

- A. The bridge will not be subject to prolonged closure for the completion of the work in this Specification.

4. METHOD OF MEASUREMENT

The Item Span Balance shall not be measured

5. BASIS OF PAYMENT

The lump sum price for the **SPAN BALANCE** bid shall include all items indicated for this specification, unless otherwise noted.

No payment will be made for repair of, or replacement of, damaged material, which was made necessary due to the Contractor's operations.

Partial payments subject to retainage will be made for **SPAN BALANCE** as follows:

Forty percent will be paid after the East Bound Bridge has been balanced according to this Specification.

Forty percent will be paid after the West Bound Bridge has been balanced according to this Specification.

Remainder shall be paid upon removal of all materials and apparatus required for this work from the site.

TRAFFIC GATES

1. DESCRIPTION

This work consists of furnishing, installing, aligning, adjusting, lubricating, testing, painting, and placing in satisfactory working condition the Traffic Gates as shown on the Plans and specified herein.

The work shall include, but not be limited to, the following tasks:

- A. Replacement of (8) eight traffic gate assembly.
- B. Removal of existing gate supports and concrete pedestals. Furnishing and installing new concrete pedestal.
- C. Demolition of existing Traffic Gates shall be paid for under "Mechanical Demolition" Item.

The Contractor shall coordinate with the work in section Movable Bridge Electrical System.

2. MATERIALS

General Requirements

- A. Warning Lights shall be in accordance with the requirements of Illinois State Manual of Traffic Control Devices (MUTCD). Each warning light shall be a red light and visible from both directions along the sidewalk. Adjacent lights shall flash alternately.
- B. The traffic gates shall be equipped with audible distinctive gongs mounted on traffic light pole, as required by the AASHTO LRFD Movable Highway Bridge Design Specifications, First Edition 2000, including 2002 interim revisions. The audible gongs shall be controlled by the Bridge Control System.
- C. The traffic arms shall be equipped with flashing red lights, powered from within the gate power enclosures, as required by the AASHTO LRFD Movable Highway Bridge Design Specifications, First Edition 2000, including 2002 interim revisions. The gate lights shall be wired to be turned on before the gate arm begins to descend with a limit switch also in the circuit that turns on the lights anytime the arm is not fully up.

The traffic gate shall be Model VW-4, as manufactured by B&B Roadway, or an approved equal meeting all specifications defined herein.

- A. Housing: The operating mechanism and main control components shall be contained in a weatherproof housing. The housing shall be constructed of either wrought 304 stainless steel, or wrought 5054-H32 or 6061-T6 aluminum. Fabrications shall be welded, and use 304 or 316 stainless steel fasteners when required. Exterior surfaces shall be painted aluminum. All fasteners shall be corrosion resistant.

Housing design shall allow for easy removal of the arm shaft assembly as a unit, including bearings and main arm crank, for ease of service. Arm assembly mounting design shall be fully gasketed and shaft openings shall incorporate O-ring seals.

Front and rear access doors shall be mounted on full cross bronze straps. Hinges shall be of the slip-off type and shall have stainless steel pins. Door handles, two per door, shall use a vise action to compress a neoprene bulb-type gasket to seal the door openings.

- B. Mounting: The gate shall be fixed to the foundation using four 3/4" diameter minimum anchor bolts. The gate housing base shall provide four 1" x 1 3/8" slotted holes on a 20 1/4" square pattern.
- C. Arm: The gate arm shall be 4" square, 6005-T5 aluminum extruded tubing. Maximum arm length shall be 40' from the centerline of the housing. Stainless steel truss cables and a damping type bumper rod shall be furnished with longer arms at the discretion of the manufacturer. Front and rear arm surfaces shall be covered with alternating red and white pre-stripped diamond grade reflective sheeting. Stripes shall be 6" wide, and shall slope at 45 degrees down toward the arm tip. Remaining exposed surfaces shall be painted white.
- D. Arm Base: The arm base shall be designed with a shear pin mechanism to minimize damage to the gate and vehicle in the event of a collision. In the event of an impact, the shear pin shall break, allowing the arm to swing approximately 75 to 80 degrees. At the

full open position, a spring-loaded latch shall engage, preventing the arm from swinging back into traffic. Arm shall be easily reset by manually releasing the latch, rotating the arm back into position and replacing the shear pin.

- E. Arm Mounting Channels: A pair of two stainless steel channels shall be rigidly affixed to the ends of the main arm shaft. The channels and a steel cross member shall provide a sturdy mount for the arm, arm base assembly and counterweights.
- F. Arm Offset: Arm shall be designed with an offset to meet MUTCD height requirements.
- G. Counterweights: At the rear end of the side arm channels, hot dip galvanized counterweights shall be mounted to balance the arm. Counterweights shall be sectional and shall permit at least 10% adjustment.
- H. Arm Shaft: The main arm shaft shall be of 2" diameter SAE 4135 with a minimum tensile strength of 140,000 psi. The shaft shall be mounted in heavy duty re-lubricable ball bearings.
- I. Sidewalk Arm: Sidewalk arms with folding aluminum curtain extensions shall be provided at all warning gate locations.
- J. Operating Mechanism: The warning arm shall pivot in the vertical plane via a mechanical 4-bar linkage. The linkage shall utilize cranks keyed to the main arm shaft and transmission shaft and an adjustable connecting rod between a pair of self-aligning spherical rod ends. The connecting rod shall be of 1" diameter SAE 4130. The linkage shall be driven by a fully enclosed, double reduction, worm gear speed reducer. Gear ratio used shall produce an operation time of 11 seconds.
The velocity of the arm shall follow a sinusoidal pattern to provide smooth operation. The arm shall begin and end its full motion path with zero velocity and accelerate smoothly to maximum velocity at mid-travel.
- K. Motor: The motor shall be 1/2 hp. The motor shall be a C-face design and shall be mounted directly to the transmission. The motor shall be instantly reversing and overload protected.
- L. Braking Mechanism: The motor shall be equipped with a solenoid-release, automatic brake. The brake shall have a manual release lever to permit manual operation of the gate during emergencies or setup.
- M. Hand crank: A hand crank shall be provided with each gate to facilitate manual operation of the gate.
- N. Limit Switch: The gate limit switch assembly shall be a self-contained unit. The assembly shall provide 8 independent SPDT control switches. Switches shall be rated for 15 amps at 480 VAC. Switches shall be controlled by individually adjustable cams. The limit switch assembly design shall permit adjustment of all cams with the gate in any position. The limit switch assembly shall have a removable cover to help prevent accidental contact with switch terminals. Shaft, cams, bushings and housing pieces shall be of non-ferrous corrosion resistant materials.

- O. Warning Lights: The warning light shall be B&B Roadway Model L4 or an approved equal.
- P. Warning Gong: The warning gong shall be Model G-12, by B&B Roadway, or an approved equal. .
- Q. Safety Switches, Terminal Blocks and Wiring: A manual disconnect switch shall be provided, pre-wired at the factory to break the main motor leads, to protect personnel during service. A hand crank safety switch shall be provided to prevent powered actuation of the gate during manual operation. Safety switches shall be installed and set at the factory to break the control circuit when either access door is opened. Door safety switches shall have a pull-to-override feature for test operation and shall automatically reset when doors are closed. Control components and terminal blocks shall be mounted inside an electrical enclosure mounted from the sidewalk side access opening, opposite the roadway. Pressure-type, modular terminal blocks shall be fully labeled and clearly coded to wiring diagrams. All control wiring shall be clearly coded to wiring diagrams and shall terminate at the terminal block. Connections to screw-type terminals shall have lugs. Conductors shall be #14 AWG stranded, minimum.

3. CONSTRUCTION REQUIREMENTS

- A. The Traffic Gate manufacturers shall submit for approval a certified print showing at a minimum the following:
 - 1. All external mounting dimensions
 - 2. The ratings and information that will appear on the nameplate
 - 3. The location of all lubrication ports
 - 4. Lubrication recommendations
 - 5. Schematic diagrams showing the internal wiring of the variable frequency drive (VFD) enclosures and interconnecting wiring between the VFD enclosures. The schematic shall show where external power and control sources are to be terminated.
- B. The traffic shall span the vehicular roadway lane width in each direction.
- C. The warning gongs shall be installed on each on-coming mast arm.
- D. Once the Contractor is satisfied that all traffic gates are installed and adjusted properly, the Engineer shall be notified. The Engineer will observe four consecutive operations of each Traffic Gate prior to approval.
 - 1. Demonstrate operation of each gate.
 - 2. Demonstrate operation of warning lights and gongs.
 - 3. Demonstrate door switch safety interlock and manual operation using hand crank.

4. METHOD OF MEASUREMENT

Measurement for traffic gates shall be each gate assembly.

5. BASIS OF PAYMENT

The work under this Item will be paid for at Contract unit price each for **TRAFFIC GATES**.

Price shall be payment in full for all materials, labor, tools and all incidental work to completely install and test each traffic gate assembly as shown on the Plans and directed by the Engineer,

BARRIER GATES

1. DESCRIPTION

This work consists of furnishing, installing, aligning, adjusting, lubricating, testing, painting, and placing in satisfactory working condition the Retractable Barrier Gates as shown in the Plans and specified herein.

The work shall include, but not be limited to, the following tasks:

- A. Replacement of existing two (2) barrier gate assembly.
- B. Removal of existing and installation of new foundations for the new retractable barrier gates. Manufacturer shall provide anchor bolts and a mounting template for each gate.
- C. New concrete pedestal for all retractable barrier gates.
- D. Removal of existing concrete pedestal furnishing and Installing new gate supports.
- E. Demolition of existing Traffic Gates shall be paid for under "Mechanical Demolition" Item.

The Contractor shall coordinate with the work in section Movable Bridge Electrical System

2. MATERIALS

- A. The retractable barrier gates shall be Lokran retractable type gates as manufactured by Lokran Industries, Inc, P.O. Box 2988, Ashtabula, Ohio 44005-2988, telephone (440) 964-6658, fax (440) 224-0304 or approved equal. Each barrier gate shall be designed for an energy dissipation level of 231,000 foot-pounds. The design standard vehicle shall have a gross vehicle weight of 1800 pounds with an impact velocity of 62 miles per hour. Each barrier gate shall stop the design standard vehicle in a maximum distance of 32 feet while satisfying the following criteria. The design standard vehicle shall decelerate at a rate not greater than 9.5 g's. An unrestrained occupant, free to move within the design standard vehicle, shall not strike an interior surface with a velocity greater than 25 feet per second. Each barrier gate safety net shall be the retractable type. Non retractable type safety nets, including traffic arms and barrier gates requiring any component parts replaced after an impact within the design criteria, are not acceptable. After an impact within the design criteria and upon release of the energy absorbing brakes, the retractable safety net shall automatically retract from the extended position and reset to the normal mode of operation.

- B. Mounting: The barrier shall be fixed to the foundation using nine 1 1/2" diameter anchor bolts. The barrier housing base shall provide 1 5/8" mounting holes.
- C. Retractable Safety Net: The safety net shall consist of four wire ropes. The three lower ropes shall be horizontal and separated by a distance of 12 inches with each independently capable of retarding an errant vehicle to the above levels of performance. A fourth wire rope shall act as a centenary to suspend the safety net in its normal position without sag.
- D. Energy Absorption Brakes: The brakes shall be non-asbestos bonded disk brakes capable of absorbing errant vehicle energy to the above levels of performance under all weather conditions. *The rate of wear shall be less than 2% of brake pad thickness after 300 full braking cycles.*
- E. Net tensioning springs: The net tensioning springs shall provide tension to the safety net to suspend it in its normal position and to return the safety net to its normal position from the extended position. The net tensioning springs shall be preset helical coils to assure against over stressing.
- F. Brake and Spring Housing: There shall be a brake and spring housing at each end of the safety net. Each housing shall have rolling contact with the support structure for raising and lowering of the safety net in normal operation. Each housing shall rest solidly against the support structure during emergency operation. The housings shall be capable of carrying all loads consistent with the above levels of performance. All rotating parts of each housing shall be equipped with sealed anti-friction bearings to assure minimum maintenance.
- G. Counterweight: Each housing shall be counterbalanced for the efficient raising and lowering of the safety net. The weight of each counterweight shall exceed the total weight of one assembled housing plus one half the weight of the safety net. The counterweights shall be independent of the emergency operation of the retractable barrier gate to assure against any catapulting counteraction of the barrier gate. Retractable barrier gates with both the payout cables and counterweight on the same drum are not acceptable.
- H. Lifting Drive, Motor and Controls: Each retractable barrier gate shall travel vertically at a rate of at least 1 ft/sec during normal operation. There shall be a lifting drive for each housing. Each lifting mechanism, two per barrier gate, shall consist of a traction drive, gear reducer, gate up and gate down positioning limit switches (each limit switch – total of four (4) per gate shall contain 8 N.O. and 8 N.C. contacts). A 3-phase six pole non-fused in-sight disconnect switch shall be furnished for each motor. A hand wheel limit switch shall be provided, to disconnect motor controls when a hand wheel is installed, to prevent powered operation of the gate during manual operation. The retractable barrier manufacturer shall supply a Variable Frequency Drive (VFD) for each lifting drive motor. The VFD shall be sized to properly operate the motor. The VFDs shall be provided in a single NEMA 4X 316 stainless steel enclosures. The enclosure shall contain a circuit breaker sized to protect the VFDs, terminal blocks identified to match the barrier gate terminals, and all wiring and auxiliary components to provide a complete operational system. Electrical power and control wiring to the VFD enclosure, each barrier gate location, and electrical grounding at each barrier gate location shall be provided by the Electrical Contractor. Independent motor controls shall be provided by the Electrical or Control Contractor. Each gear reducer shall include a stop-motion switch (speed switch) for detecting motor/gate net stoppage.

- I. Electrical Facilities: A Marine Grade, 120-volt, 20-amp, duplex grounding, ground fault circuit interrupter in a weatherproof enclosure with approved NEC lift cover plate shall be furnished and installed on each steel tower.
 - J. Gate Lights & Flasher: On each gate safety net centenary cable, provision for mounting five (5) lightweight, dual lens, molded plastic, weatherproof, (7-inch) diameter light shall be installed. Each light assembly shall utilize a 12-volt, 1000-hr, 21 candlepower lamp (18W) and shall be supplied. Lights shall be arranged to flash alternately. A 120/12-volt solid state flasher with alternately .50 seconds on, .50 seconds off flashing circuits. The flasher shall be fused with 120V, 10 amp fuse.
 - K. Support Structure and Foundation: The support structure shall enclose the housing assemblies, the counterweights, the lifting drives, motors, and controls. Each support structure shall be capable of carrying all loads consistent with the above levels of performance and shall be capable of transmitting these loads to the foundation by way of anchor bolts. An anchor bolt setting plan shall be provided by the retractable barrier gate manufacturer. Foundations designed for these transmitted loads and for local site conditions shall be provided by others.
 - L. Environmental Protection: All wire rope and exposed mechanical parts of the retractable barrier gates shall be galvanized. The wire rope shall be of a stainless steel material. All low-stress fasteners shall be 304 stainless steel. All fasteners requiring high strength steel, such as those for clamping wire ropes, shall be zinc-coated or coated by the "Dacromet" process. The disk brake rotors shall be stainless steel. Structural steel support members of the retractable barrier gates shall be painted on the exterior surfaces in accordance with the painting specification of the owner.
 - M. Retractable Barrier Gate Spare Parts:
 1. One (1) replacement flasher.
 2. Five (5) 7 inch diameter dual lens safety net lights.
 3. Ten (10) replacement 12-volt (18W) lamps.
 4. Four (4) snap action switch inserts for the rotary cam switches.
 5. One (1) limit switch for the main access door.
 6. One (1) limit switch for the manual operation access cover.
 7. One (1) cabinet heater for the electrical enclosure.
 8. One (1) left hand motor/brake with heater.
 9. One (1) right hand motor/brake with heater.
3. CONSTRUCTION REQUIREMENTS
- A. The Retractable Barrier Gate manufacturer shall submit for approval a certified print showing at a minimum the following:
 1. All external mounting dimensions.
 2. The ratings and information that will appear on the nameplate
 3. The location of all lubrication ports
 4. Lubrication recommendations

5. Schematic diagrams showing the internal wiring of the variable frequency drive (VFD) enclosures, barrier gates, and interconnecting wiring between the VFD enclosure and barrier gates. The schematic shall show where external power and control sources are to be terminated.
- B. The retractable barrier gates shall span the vehicular roadway lane width in each direction.
- C. Once the Contractor is satisfied that all retractable barrier gates are installed and adjusted properly, the Engineer shall be notified. The Engineer will observe four consecutive operations of each Retractable Barrier Gate prior to approval.
 1. Demonstrate door switch safety interlock and manual operation using hand crank.
 2. Demonstrate operation of each gate.
4. **METHOD OF MEASUREMENT**
Measurement for barrier gates shall be each gate assembly.
5. **BASIS OF PAYMENT**
This Item shall be paid for at the contract unit price for each **REPLACEMENT OF BARRIER GATES**, installed and tested.

Price shall be payment in full for all materials, labor, tools and all incidental work to complete the work as shown on the Plans and directed by the Engineer.

SUMP PUMP

1. DESCRIPTION

This work under this Item shall consist of furnishing all labor, materials, equipments and incidentals required to install four (4) automatic non-clog submersible pumps and all associated accessories in the four (4) counterweight pits as shown on the contract plans or specified herein under this Item.

The work shall include but not limited to the following:

1. Complete cleaning of the counterweight pit from all dirt and debris.
2. The removal and demolition of the existing sump pumps, discharge pipings and all associated components shall also be included under this Item. The demolition shall include but not be limited to the following:
 - A. All existing sump pump, associated discharge piping and all supports.
 - B. All existing pit screens and all associated supports.
 - C. All existing pump controls and all associated electrical components.

2. MATERIALS

1. Sump Pump

Each sump pump shall be of heavy-duty submersible non-clog pump type, model SB3SD150M4-4 as manufactured by Hydromatic Pump or approved equal. The pump volute, motor and sealing housing shall be ASTM A536 ductile iron, Grade 60-40-18. All fasteners exposed to the pumped liquid shall be 300 series stainless steel.

Each pump shall have a 3 inch discharge capable of handling 2-1/2 inch diameter solids. The pumps shall be non-overloading throughout the entire range of operation without employing a service factor. The pump shall reserve a minimum service factor of 1.20. The performance curve submitted for approval shall state in addition to the head and capacity performance, the pump efficiency, impeller diameter and solid handling capabilities.

A. Motor

The stator, rotor and bearings shall be mounted in sealed submersible type housing. The stator windings shall have Class F insulation, (155 degree C or 311 F), and dielectric oil filled motor, NEMA B design. Three phase motors shall use magnetic starters with overload relays located in the control panel for further protection. Because air-filled motors do not dissipate heat as efficiently as oil filled motors, air filled designs shall not be acceptable.

Stators shall be securely held in place with threaded fasteners so they may be easily removed in the field without the use of a heat or a press. Stators held by a heat shrink fit shall not be acceptable. Stators must be capable of being repaired or rewound by local motor service station. Units which require service only by the factory shall not be acceptable. No special tools shall be required for pump and motor disassembly.

B. Bearing and Shaft

An upper radial bearing and lower thrust bearing shall be required. Both the upper radial bearing and the lower thrust bearing shall be a heavy duty single row ball bearing which is permanently lubricated by the dielectric oil which fills the motor housing. Double row, sealed grease packed bearings shall not be acceptable. Bearings which require lubrication according to a prescribed schedule shall not be acceptable. Bearings shall be locally available.

The shaft shall be machined from annealed and cold finished 303 stainless steel and be a design which is of larger diameter with minimum overhand to reduce shaft deflection and prolong bearing life.

C. Seals

The pump shall have a mechanical seal, John Crane Type 21, BF1C1. The seal shall be used with the rotating seal face being carbon and the stationary face being ceramic. The seal shall be replaceable without disassembly of the seal plate and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. Units which require the use of tungsten-carbide seals or foreign manufactured seals shall not be acceptable. Seals shall be locally available.

D. Impeller

Impeller shall be two-vane, semi-enclosed design and have pump-out vanes on the backside of the impeller to prevent grit and other materials from collecting in the seal area. Single vane impellers which cannot be easily trimmed and which do not maintain balance with the wear

causing shaft deflections and reducing seal ad bearing life are not acceptable. Impeller shall not require coating. Because most impeller coatings do not remain beyond the very early life of the impeller, efficiency and other performance data submitted shall be based on based on performance with an uncoated impeller. Attempts to improve efficiency by coating impeller shall not be acceptable.

Impellers shall be dynamically balanced. The tolerance values shall be as listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames.

RPM	Tolerance
1750	0.02 in-oz./lb. of impeller weight

The impeller shall be slip fit to the shaft and key driven. A 300 series stainless steel washer and impeller bolt shall be used to fasten the impeller to the shaft. Threaded shafts for the attachment of the impeller shall not be acceptable.

E. Casing

The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type with an automatic pipe coupling arrangement for ease of installation and piping alignment. The casing shall accurately machined and bored for register fits with suction and casing.

F. Painting

The pump shall be painted after assembly with vinyl or epoxy coating. The paint shall be applied in one coat.

G. Electrical Power Cord

The electrical power cord shall be STW-A, water resistant 600V, 60 deg C, UL and CSA approved and applied dependent on amp draw for size.

- A. The pump shall be double protected with compression fitting and an epoxy potted area at the power cord entry to the pump. A separation between the junction box area of the pump and the motor by the stator lead sealing gland or terminal board shall not be acceptable.
- B. The power cable entry into the cord cap assembly shall be first made with a compression fitting. Each individual lead shall be stripped down to the bare wire, at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary action.
- C. The power cord assembly shall then be connected to the motor leads with insulated butt connectors rather than a terminal board that allows for possible leaks.
- D. The cord cap assembly where bolted to the motor housing shall be sealed with a BUNA N Rubber O-Ring on a beveled edge to assure proper sealing.

2. Pit Screen

The material for the pit screen construction and all associated supports shall be 316 stainless steel.

3. Pump Controller

The controls for each sump pump shall consist of a NEMA-4 weather-protected UL labeled simplex control panel, with a lockable "dead front" outer door, and a separate inner-door with an interlocked safety disconnect. The panel shall include a seal failure contacts, heat failure contacts, control circuit transformer, starter, circuit breaker, O.L Block, H-O-A switch, run light, alarm bell and light with silence push-button, and dry remote alarm contacts. Three (3) level switches shall control pump "on", "off", and "alarm" levels, and shall be suspended from a wall-mounted float mounting bracket. The automatic switching device shall start the pump when the when the depth of the water level reaches 24 inches from the bottom of the sum pit and stop the pump when the water level reaches 12 inches from the bottom of the pit wall.

4. Float Switches

The contractor shall furnish and install and test completely the float switches and all associated mounting supports and details. The contractor shall furnish three (3) float switches for each pump in the counterweight pit.

The float switches shall be the Control Duty Mechanical Narrow Angle Externally Weighted Switch, Model No. 2900 as advertised by Metropolitan Industries or Approved Equal. The float shall be constructed of a durable ABS outer shell. It is tested and proven to be leak proof, shock proof and impact resistant for use with intrinsically safe circuits. The external cord weight shall be made of 1 304 stainless steel. The float shall have a split weight design which allows for easy adjustment, and a secure and permanent attachment to the cord.

The mechanically activated micro switch design shall have a recommended operating temperature of 32-190°F and a rated at 10 Amps at 120 Volts or 5 Amps at 240 Volts, A.C.

The float switches power cords shall be a chlorinated polyethylene (CPE) type SJOOW-300 Volt on 16/2 for normally open switch.

Each sump pit shall be furnished completely with two (2) normally open controls to control the pump. One control is set for turn off level and the other is set for turn on level. A third float switch is set for direct alarm actuation.

The float switch support shall be PVC pipe anchored to the sump wall. Each float switch shall be tied separately to the float support and set at the appropriate level. The contractor shall submit to the engineer the float switch mounting support and pipe support details for approval before fabrication or installation.

3. CONSTRUCTION REQUIREMENTS

Counterweight Pit

The contractor shall completely clean the counterweight pit from all dirt and debris. The cleaning shall include complete draining of all existing water, debris, sand and all other materials. The

pits may contain hazardous materials or substance that should be cleaned in accordance o all State and Federal regulations in the counterweight pit. The cleaning of the pit shall include any hazardous material or substance in the counterweight pit.

The contractor shall completely remove and demolish all existing piping and electrical wires from the counterweight pit.

Pit Screen

The contractor shall furnish and install a pit screen for each sump pump. The screen shall be constructed to protect the pump and prevent debris from entering the pump. Provisions shall be made in the pit screen for the easy removal and installation of the sump pump. Provisions shall also be made for all electrical connections and all associated sump pump electrical accessories and components.

The contractor shall submit to the engineer for approval details of the pit screen construction, construction materials, and how the pit screen is supported in the pit before beginning fabrication and/or installation.

Testing

Commercial testing shall be required and include the following:

1. The pump shall be visually inspected to confirm that it is built in accordance with the specifications as to the HP, voltage, phase and hertz.
2. The motor housing chambers shall be meggered for infinity to test for moisture content and insulation defects.
3. Pumps shall be allowed dry to check for proper rotation.
4. Discharge piping shall be attached, the pump submerged in water and the amps readings shall be taken in windings, shall be checked with a bridge to determine if an unbalanced resistance exists. If so the stator shall be replaced.
5. The pump shall be removed from water, meggered again, dried and the motor housing filled with dielectric oil.

Submittals

The contractor shall submit to the Engineer for review and approval prior to any fabrication and/or installation.

- A. All pump manufacturing data, including but not limited to pump performance curves, pump controller data including wiring diagrams.
- B. Discharge piping layout and all supporting details.
- C. Pump controller location and supporting details.
- D. Float switch mounting system and supporting details.
- E. Pit screen construction details with all associated support and materials.

The contractor shall provide a complete pump Operations and Maintenance Manual.

4. METHOD OF MEASUREMENT

Sump pumps shall be measured for payment by EACH. It shall include sump pump, piping, pump controller, floats, pit screen and all incidentals including start-up and testing.

5. BASIS OF PAYMENT

The work under this Item will be paid for at Contract unit price each for **REPLACEMENT OF SUMP PUMPS.**

The cleaning of the counterweight pit will be paid for at Contract unit price each for **COUNTERWEIGHT PIT CLEANING.**

TRAFFIC SURVEILLANCE

TRAFFIC SURVEILLANCE - GENERAL

Effective: June 1, 1994 Revised: July 30, 2008

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 Engineer, the 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.

T.S.C. - The Traffic Systems Center of the Illinois Department of Transportation with offices at 445 Harrison Street, Oak Park, Illinois 60304-1499.

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 Engineer. No raceways shall be allowed to enter cabinet through the sides or backwalls.

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 T.S.C. Engineer, Resident Engineer and Electrical 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 T.S.C. 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 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 Traffic Systems Center 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, Traffic Systems Center personnel 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 TSC 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 T.S.C. 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 Traffic Systems Center and four (4) full size sets of "as-built" plans to the 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 T.S.C. personnel. 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 T.S.C. personnel.

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. Traffic Systems Center staff 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 T.S.C. 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 T.S.C. staff 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 T.S.C. 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 T.S.C. 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 T.S.C. 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.

GALVANIZED STEEL CONDUIT ATTACHED TO STRUCTURE

Effective: June 1, 1994

Revised: November 12, 2008

DESCRIPTION

This item shall consist of furnishing and attaching to structure galvanized steel conduit of the size specified including all condulets, reducers, adapters, couplings, junction boxes, galvanized mounting hardware, and all miscellaneous items necessary for the proper installation at the locations indicated on the plans or as directed by the Engineer.

MATERIALS

The conduit shall conform to the requirements of applicable portions of Sections Art. 810, 811, & 1088.01 (a) of the Standard Specifications for Road and Bridge Construction.

INSTALLATION DETAILS

Galvanized steel conduit shall be attached flush to the structure where possible. The conduit shall be installed in a manner such that it will not obstruct or be subjected to damage by vehicular traffic. Clamps or hangers shall be placed at all points deemed necessary to hold the conduit rigidly in place, with a maximum interval length of 5 feet (1.5m) except where otherwise specified. The conduit shall not be attached to the outside face of outside girders nor to the underside of bottom flanges of girders, nor in any manner that would detract substantially from the original aesthetics of the structure.

The Contractor shall exercise care in installing the conduit to insure that the completed conduit raceway is smooth, free from sharp bends or kinks, and has the minimum practicable number of bends. Crushed or deformed conduit shall not be used or accepted.

Conduit shall be continuous from outlet to outlet unless interrupted by condulets placed for the purpose of pulling cables or making short radius bends. A minimal use of water-tight flexible metal conduit of the same size as the galvanized conduit will be allowed where indicated on the plans or as directed by the Engineer. The flexible metal conduit shall be considered incidental to the cost of GALVANIZED STEEL CONDUIT.

All conduits and fittings shall be assembled in the proper manner, such that all joints will be mechanically secure, water-tight, and provide electrical continuity. One conduit expansion/contraction fitting shall be used for crossing each structure expansion joint encountered in a conduit run.

All galvanized steel conduit terminations shall be temporarily capped to prevent water and other contaminants from entering during construction operations. The conduit shall be swabbed or blown clear of any debris before installation of cable.

METHOD OF MEASUREMENT

The length for measurement shall be the distance horizontally, vertically or diagonally along a straight line measured between changes in direction of the conduit and the connection to terminal facilities or polyethylene duct.

BASIS OF PAYMENT

The item will be paid at the contract unit price per lineal foot (meter) as GALVANIZED STEEL CONDUIT ATTACHED TO STRUCTURE, CONDUIT ATTACHED TO STRUCTURE, GALVANIZED STEEL, PVC COATED size specified. The price will be payment in full for furnishing all materials listed under the description and installing the conduit complete in place.

ELECTRIC CABLE NO. 19 - 6 CONDUCTORS OR 12 CONDUCTORS

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:

Number of Cable Pairs	Average Mutual Capacitance	
	<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:

Number of Cable Pairs	Pair-to-Pair Capacitance Unbalance (Max)	
	<u>mmf/kft</u>	<u>(mmf/km)</u>
	<u>Max. Individual</u>	
Less than 12	100	(181.1)

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>	Pair-to-Shield Unbalance (Max)	
	<u>mmf/kf</u>	<u>(mmf/km)</u>
Less than 12	250	(820)

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>	Maximum Resistance	
	<u>ohms/kf</u>	<u>(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 NO. 19 of the number of conductors specified, for furnishing all materials, making all electrical connection and installing the cable in place.

TEMPORARY AND PERMANENT INSTALLATION OF 6C NO 19 CABLE

Effective: April 23, 2009

Description

This item shall consist of furnishing and installing temporary 6C No. 19 cable, as well as furnishing and installing permanent cable. This shall include installing GS Conduit and Cable.

Materials

GS conduit: This shall be according to Special Provision GS conduit Attached to Structure.
 6C NO. 19 Cable: This shall be according to Special Provision Electrical Cable No. 19-6 Conductors or 12 Conductors.

Installation

Temporary installation of existing 6C No. 19 Cable: Prior to removal of barrier wall from Station 365 + 60 to Station 372 + 37, the contractor shall install 2" GS conduit under Congress Parkway, running the full length of the barrier wall removal. When the barrier wall is removed, the 4" conduit in the west end and east end shall be connected to the 2" GS conduit. This conduit shall be protected from traffic as approved by Engineer. The Contractor shall remove the existing 6C No. 19 from barrier wall between junction boxes located at Stations 360 + 00 and 372 +50. The Contractor shall run a new 6C No. 19 cable between junction boxes located at Station 360 + 00 and 372 + 50. Splicing shall be incidental to Special Provision for 6C No. 19 cable. The cable shall not be disconnected for more than 5 days. The changeable Message sign at the post office will then be tested by Traffic Systems Center Engineer. A successful test shall determine if the 6 C No. 19 is installed correctly.

During Stage II, the electrical junction box at Station 377 + 01 will be relocated. A temporary cable must be connected to the Changeable Message Sign to ensure minimum disruption of service.

Installation of new 6C No. 19 Cable: A 4" surveillance conduit shall be installed in the base of the barrier wall and shall be connected to existing 4" conduit at both ends of this section. A new 6C No. 19 cable shall be spliced between junction boxes at Stations 360 + 00 and 372 + 50. The changeable message sign at the post office will then be tested by Traffic Systems Center Engineer. A successful test shall determine if the 6C No. 19 is installed correctly.

Basis of Payment: This item shall not be paid for separately, but shall be considered incidental to the 2" GS conduit, and 6C No. 19 Special Provisions.

ELECTRICAL

BRIDGE ELECTRICAL

I. DESCRIPTION.

- A. The work shall consist of furnishing, installing, and placing in satisfactory operating condition the complete electrical equipment for operation of the bascule spans and its auxiliaries, as indicated on *the* Plans, called for in these specifications, or as may be required for a complete bridge electrical work. The work shall include but not be limited to the furnishing, installing, testing and placing in satisfactory operating condition the conduit and wiring systems for the new barrier gates, traffic gates, and for the approach signage, lighting and traffic signaling as indicated on the Plans under other items. The Contractor's attention is also directed to the requirements for electrical work appearing in other items of these Specifications.
- B. It is the intent and purpose of these Specifications to cover and include all apparatus and appliances to properly install, wire, connect, equip, test, adjust, and put into approved working order the respective portions of the electrical work herein specified. The work shall also include disconnecting and removing the existing equipment and facilities to be replaced. Any incidental apparatus, appliance, material, or labor not herein specifically mentioned or included that may be found necessary to comply with the requirements of the related documents and referenced standards or codes shall be furnished by the Contractor just as if specifically mentioned in these Specifications and without extra cost.
- C. The alignment and fastening of electrical equipment to be incorporated into the bridge machinery, such as the span motor, brakes, motor encoders and transmitters, position indicators, selsyns, and overspeed switches, shall be done under "Mechanical Work".
- D. Contractor shall investigate spaces through which equipment must be moved. Arrange to have equipment shipped from manufacturer in crated sections of size suitable for moving through restricted available spaces.

- E. Shop drawings and operation and maintenance manuals shall be provided as specified hereinafter.
- F. The electrical work shall include but not be limited to the following:
 - 1. Removals, Relocations, and Equipment Preservations
 - a. Remove the existing 600 V dc bridge machinery electric power service in the East Side and West Side Bridge Control Houses. Coordinate required electric power service de-energizing work with Chicago Transit Authority (CTA).
 - b. Remove the existing three phase, 208 V ac facilities electric power service in the East Side and West Side Bridge Houses. Coordinate required electric power service de-energizing work with the Commonwealth Edison (ComEd) utility company.
 - c. Remove existing 600 V dc switchboard panel in the East Side and West Side Bridge Control Houses.
 - d. Remove all existing dc motor controller equipment including secondary resistor banks, contactors and wiring.
 - e. Remove existing control desk including all top metering, indicating and control devices. Disable all existing control desk functions. Remove all existing control devices, relays and wiring inside the control desk as needed.
 - 2. Electrical work shall also include but not be limited to:
 - a. Furnish and install a new 480 V ac, three phase, 60 hertz electric power service from ComEd as normal power source including main service entrance disconnect and utility metering cabinet. Metering cabinet shall conform to ComEd installation requirements. Contractor shall install equipment foundation for ComEd owned power distribution equipment and step-down transformer as shown on plans.
 - b. Furnish and install a new emergency packaged engine generator set to provide emergency power source.
 - c. Furnish and install an automatic transfer switch to automatically transfer from normal power source to emergency power source upon loss of normal power source. Upon return of normal power, the ATS shall automatically transfer from emergency power to normal power.
 - d. Furnish and install a new power distribution switchboard to serve both east side and west side bridge houses.

- e. Furnish and install new motor control centers (MCC) as shown on the plans.
- f. Furnish and install new motor disconnect switches including for motor and machinery brakes and span locks.
- g. Replace existing normal dc control system with new, vector-controlled motor drives. Furnish and install feedback encoders, and over speed check switches mounted to the new main leaf motors.
- h. Furnish and install programmable Logic Controller (PLC) based control system.
- i. Furnish and install new control desks.
- j. Furnish and install new main position rotary-cam limit switches and fully seated limit switches/over travel limit switches.
- k. Furnish and install new span navigational lights including feeder circuits.
- l. Furnish and install conduit, wireways and other raceways, and wiring to connect all bridge power and control circuits including riser between switchboard rooms and machinery rooms.
- m. Furnish and install conduit and wiring for traffic control equipment power and controls including barrier gates, traffic warning gates, traffic signals, air horns, warning gongs, and advance warning signs.

II. MATERIALS.

A. Conformance

- 1. All electrical equipment and its installation shall conform to the requirements of the latest revision of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials, except as may be otherwise provided herein.
- 2. Materials and construction shall conform to the requirements of the current National Electrical Code and to any applicable local rules and ordinances. The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.
- 3. If a component is available with an approval / listing classification by Underwriter's Laboratory or another nationally recognized independent testing organization, the component that has such a designation shall be provided.

B. Equipment and Material Provisions

1. All equipment and materials shall be new. All equipment, materials, and workmanship shall be first-class in every particular and shall be manufactured and erected to the satisfaction of the Engineer. The Contractor shall warrant the in-service working of the electrical installations for one year or the manufacturer's warranty period, whichever is greater, following project acceptance by The Department. If the Contractor has any objection to any feature of the electrical equipment as designed and laid out, he must state his objection at once in writing to the Engineer prior to fabrication and/or installation, otherwise his objection will be ignored if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus. Changes shall be made at the discretion of the Engineer.
2. Each piece of electrical equipment and apparatus shall have a corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, the rating or capacity of the equipment or apparatus, etc.
3. All metal parts of the installation, except structural steel, shall be of corrosion-resisting material, such as bronze or stainless steel. Malleable iron or steel with a hot-dip galvanized finish shall be used where specified herein. Structural steel shall conform to the requirements given under "Structural Steel".
4. All mounting hardware and all wire and cable terminals shall be vibration proof.
5. If any changes from the Plans or these Specifications are deemed necessary by the Contractor, details of such changes and the reasons therefore shall be submitted for approval as soon as practicable, but before the first submittal. No such changes shall be made nor work started without approval of the Engineer.
6. Material requirements for specific apparatus, equipment, and materials are found in the articles under "Construction Requirements" in this item.

C. Bridge Control System Vendor

1. All apparatus and equipment comprising the bridge control system, including, but not limited to, drives, motors, brakes, limit switches, motor controls, control cabinets, special control panels, control desk, controllers, interfacing equipment, and other apparatus required to provide a complete functioning system, shall be manufactured or furnished and assembled by a single qualified control system vendor. The vendor shall assemble the control panels and console at an Underwriters Laboratory approved Facility in accordance with UL 508.

2. The control system vendor shall have experience in providing electrical control systems for movable bridges of various types, including vertical-lift; bascule, swing bridges, and control systems, including Vector-Controlled, AC SCR, DC drives and relay-based bridge controls. Such experience shall be demonstrated by identifying a minimum of five movable bridges for which the system vendor has provided complete systems including Vector-Controlled, DC and SCR drive motor controls and controller logic within the past ten years. The past experience shall include similar bridge electrical and control systems work performed in the State of Illinois.
3. The control system vendor shall assume complete system responsibility for the integrated functioning of all components to provide a satisfactory assembled system operating in accordance with specified requirements. The control system vendor shall be responsible for the detailed schematics and fabrication of the total control and power distribution system to ensure compatibility of equipment and suitability for the intended system functioning. The vendor shall provide supervisory assistance in the installation of equipment to ensure maximum reliability and ease of maintenance.
4. The system vendor shall provide a field service staff having the capability of providing services for field coordination of construction and final adjustments to the control and drive systems. Upon final acceptance of the bridge by The Department, the system vendor's staff shall provide on-call warranty service for a period of one year. Field staff shall be capable of responding to an emergency within eight (8) hours.
5. The Contractor shall provide written certification of compliance with specified requirements for his control system vendor. This certification shall be included in the bid documents and shall be subject to approval by The Department.

D. Qualifications

1. Due to the critical and complex technical requirements of this section, only those suppliers who can demonstrate that they possess requisite knowledge, capabilities and experience with the exact equipment being supplied shall be acceptable. In order to provide this equipment the supplier shall be pre-certified.
2. To be pre-certified a supplier must show proof of experience in designing, furnishing and commissioning bridge control systems on at least 5 movable bridges utilizing electronic drives, including vector drives. At least 2 of these bridges shall have included PLC controls.
3. The following suppliers are known to meet this pre-certification requirement:

Link Control Systems, Inc.
16 Colt Court
Ronkonkoma, NY 11779

Panatrol Corporation
7481 South Sayre Avenue
Bedford Park, IL 60638

Systems Interface
22125 17th Ave. S.E., Suite 111
Bothell, WA 98021

D. Electrical Items Covered In Other Sections of These Specifications

1. Service Equipment
2. Packaged Engine Generator Set
3. Automatic Transfer Switch
4. Integrated Bridge Control System
5. Submarine Cables
6. Panelboards and Distribution Boards

E. Working Drawings and Samples

1. Working Drawings

a. The contractor shall prepare and submit for review within thirty (30) working days after the award of the Contract the following working drawings executed in accordance with the provisions of the Contract:

- 1) Certified dimension prints of all motors, span brakes, brake wheels, limit switches, and other electrical apparatus external to the control console, control panels, panelboards and transfer switches.
- 2) A complete schematic wiring diagram, including all power, control, and lighting connections. Both electrical devices and each wire between devices shall be identified by an individual unique designation of letters, numbers, or a combination of both; and such designations shall be used wherever the devices or wires appear on other drawings. Certified dimension prints of all motors, brakes, brake wheels, limit switches, and other electrical apparatus

external to the control console, control panels, panelboards and the transfer switch. A complete set of catalog cuts for materials furnished shall be included for review at time of schematic submittal.

- 3) Layout drawings and internal connection wiring diagrams of the control console, MCC, distribution and control panels, and Vector-Controlled motor drive panels.
- 4) A schedule of electrical apparatus for each cabinet or panel which shall list each electrical device by its designation as shown on the schematic wiring diagram and shall state for each device its rating, number of poles or contacts, function, catalog number, and location.
- 5) A complete interconnection diagram(s) for all electrical apparatus and equipment used in the operation of the span and its auxiliaries. The diagram(s) shall be of the elementary type and shall show the external connections of all devices and equipment. Computer-generated interconnection lists will not be acceptable in lieu of a true interconnection diagram.
- 6) Outline drawings and complete construction details of the span position indicator system to be installed in the control desks and mounted to the machinery. Details of the indicator dial limit switches shall also be submitted.
- 7) A complete schematic conduit and cable diagram or diagrams showing the interconnection of all devices and equipment, including ducts and junction boxes, and showing all conduit. The size of each conduit, and the wire number and size of each conductor in conduit shall be shown on the diagrams. Each conduit shall be suitably numbered or lettered, and percent wire fill shall be shown.
- 8) A complete set of layout and installation drawings for the electrical work showing the location and installation, including support and mounting details, of all electrical apparatus and equipment. These drawings shall be made to scale and shall show the exact location of all conduits, cables, wiring ducts, boxes, motors, brakes, limit switches, disconnect switches, and other electrical equipment and the method of supporting them on the structure.
- 9) Detail drawings showing the construction and mounting details of all wiring troughs and raceways.

- 10) A complete list of all spare parts furnished as part of the contract.
 - 11) Material listing and specifications for the relay control cabinet, and motor drives, including relay units, terminals, and equipment for interfacing.
 - 12) The control wiring interconnection diagram. Circuit functions shall be described; all relays and contacts shall be identified by word description and by number designation. Ladder rungs and wiring between various cabinets and drives shall be numbered sequentially for reference. The ladder diagram shall be fully documented, and ladder logic relay contacts usage in other rungs shall be identified and listed. Inputs and outputs shall be referenced to locations of contacts on interconnection diagram.
 - 13) Any other drawings, which may, in the opinion of the Engineer, be necessary to show the electrical work.
- b. Certified dimension prints of the apparatus shall state in the certification the name of the job, the application of the apparatus, device designation, number required, right-hand or left-hand assembly, electrical rating, number of poles or contacts, material, finish, and any other pertinent data to show that the apparatus meets the specified requirements.
 - c. Upon completion of the work, the Contractor shall correct all working drawings, including all working drawings submitted by the electrical system vendor, to show the work as-built and shall provide two (2) sets of 22 inch x 36 inch, 4 mil thick mylar reproducible of all as-built working drawings. One (1) set to be submitted to the Resident Engineer and one (1) set to be delivered to IDOT.
 - d. All as-built working drawings submitted by the electrical system vendor, including all electrical schematics, ladder diagrams, system documentation, dimension drawings of equipment, and devices, shall also be submitted in a computerized file form as well as on mylar reproducible as specified above. The computerized file form for all electronic files shall be in "PDF" format. The electrical system vendor shall provide all pertinent drawings and data on DVD read-only disks. The electrical system vendor shall verify the compatibility of his computerized file form prior to submission.

- e. The preparation and submission of working drawings shall meet the provision for shop drawings in accordance with all the general specifications requirements included under other relevant sections.
- f. The Contractor shall submit for inspection and test, if directed by the Engineer, samples of any apparatus or device that he proposes to use as a part of the electrical installation.

2. Instruction Books and Drawing Books

- a. The Contractor shall furnish to the Engineer eight bound hard copies and eight electronic PDF color copies in compact disks of an instruction book with the title "Operation and Maintenance Manual, Volume 1 – Bridge Operator's Manual". The manual shall contain non-technical information and instructions to operate the bridge. The manual shall be operator-oriented and be oriented towards bridge operation by IDOT Operations & Maintenance personnel. The manual shall contain suitably arranged chapters including, but not limited to, the following:
 - 1) Table of Contents.
 - 2) Introduction, including a general description of the bridge and its facilities.
 - 3) Operating Procedure, including a simplified step-by-step, opening and closing procedure to normally operate the span. This description shall be augmented and cross-referenced with a layout of the control console, which shall be included in this section.
 - 4) A description of the bridge's electric power sources including methods and precautions for their selection.
 - 5) Procedure for selecting normal and emergency systems.
 - 6) A description of miscellaneous devices on the control console, such as navigation lights switch, etc., including the methods and operation of these devices.
 - 7) A description of the bridge's instrumentation and controls including normal operating ranges of console meters, operation of indicating lights, etc.
 - 8) A detailed description of sequence interlocking including methods and precautions for use of the bypass switches.

- 9) A simplified description of how the span operates under normal system operation and under the emergency system operation and how to recognize when there is a system malfunction. In addition, the procedure for operating the span when various traffic control or other span operating systems are disabled shall be provided.
 - 10) Results of acceptance testing.
 - 11) A description of Abnormal Indications such as, span over-travel, span drives permissive fault, etc.
- b. The Contractor shall furnish to the Engineer eight bound hard copies and eight electronic PDF color copies in compact disks of an instruction manual with the title "Operation and Maintenance Manual, Volume 2 - Operation of Electrical Equipment," containing the following:
- 1) Table of Contents.
 - 2) Detailed, technical operating instructions, which shall cover span operation, manual span operation, etc.
 - 3) Detailed description of all control equipment including instructions to achieve optimum settings of all limit switches, detectors, etc.
 - 4) Description of control, which shall describe in full the functions of all protective devices, limit switches, contactors, relays, transmitters and receivers, and all other electrical equipment used, both in the power service and in the control system, in connection with each step in the operating sequence. Wire and apparatus numbers appearing on the wiring diagrams shall be used in this description for identifying the various devices and circuits.
 - 5) To augment the description of control and operations, reference drawings showing locations of equipment shall be included. A layout of control apparatus in the control house and operator's room shall be included. All descriptions shall be cross-referenced with reference drawings.
 - 6) Complete span motor drive manual, including all annotated drive parameters.
 - 7) Vector-Controlled motor drive system description shall include but not necessarily be limited to:

- a) System specifications
 - b) Electrical power requirements and grounding
 - c) Application considerations
 - d) Assembly and installation procedures
 - e) Troubleshooting procedures
 - f) Vector-Controlled drive parameter adjustment procedures
 - g) Explanation of internal fault diagnostics
 - h) Shut down procedures
- c. The Contractor shall also furnish to the Engineer eight bound hard copies and eight electronic PDF color copies in compact disks of a book with the title "Operation and Maintenance Manual, Volume 3 - Maintenance of Electrical Equipment," and shall contain the following:
- 1) Table of Contents.
 - 2) Maintenance instructions for the electrical equipment, including warnings and precautions to be observed during maintenance actions. All preventive maintenance procedures are to be outlined and a chart listing all maintenance procedures in chronological order shall be provided.
 - 3) Set of descriptive catalog sheets, bulletins, maintenance instructions, and drawings covering all approved items of equipment furnished and installed under the item "Electrical Work."
 - 4) A troubleshooting flow chart for troubleshooting the bridge electrical system shall be provided to facilitate the diagnosing and correcting of malfunctions.
 - 5) Reduced size (11" x 17") prints of all approved working drawings, including all schematic wiring diagrams, control console and control panel layouts and connection diagrams.
 - 6) Relay control logic schematic wiring, ladder diagrams and electrical schematic.

- 7) Listings of all relay coils and contacts. The listing shall include:
 - a) Designation as symbol
 - b) Description of function
 - c) Drop where connected
 - d) Sheet number where used on wiring diagram
 - 8) Composite schedule of electrical apparatus.
 - 9) Complete spare parts list.
 - 10) Conduit layout and installation drawings.
 - 11) Names, addresses and telephone numbers of vendors and suppliers.
- d. The material for the operation and maintenance manuals shall be assembled to form a booklet for each volume with heavy plastic covers. Each booklet shall be approximately 9 inches by 12 inches, three-ring binder with 3-inch "D" rings, and vinyl cover to allow insertable Title Sheets. Each booklet shall be neatly entitled with a descriptive title, the name of the bridge, the Owner, the location, year of installation, Contractor, and Designer. Copies of drawings shall be in black on a white background and shall be easily legible. Blue line ozalid drawings are not acceptable. The arrangements of the booklets, the method of binding, material to be included, and the text shall all be as approved by the Engineer. The final bound volumes of the instruction books shall be completed and made available at the bridge site for use during the field testing period hereinafter specified for the electrical work.
- e. All literature, descriptive materials for inclusion in any manual, shall have all sheets numbered and listed by section in the Table of Contents.
- f. Each section/subsection shall be separated with tabbed divider sheets. Each tab shall be suitably titled.
- g. All loose-leaf paper used for reproduction shall be 20 pound, 3-hole pre-punched and reinforced with plastic or cloth tape.
- h. All copies of the Operations and Maintenance Manuals shall be distributed as follows:

- 1) One (1) copy each of Volume 1, Volume 2, and Volume 3 shall be distributed to the designer, PB Americas, Inc., 230 West Monroe Street, Suite 900, Chicago, IL 60606.
- 2) Ten (10) copies each of Volume 1, Volume 2, and Volume 3 shall be distributed to The Department.

III. CONSTRUCTION REQUIREMENTS

A. Maintaining Existing Facilities

1. The Contractor shall conduct his operations in such a manner as to maintain the existing bridge electrical equipment and systems in operating condition at all times throughout the construction in accordance with the approved work schedule and all requirements for construction staging. This includes but is not limited to navigation lights, traffic signals, warning gates, barrier gates, roadway lights, heating equipment and any other electrical facilities required for safe operation of the span. The Contractor shall furnish and install any temporary facilities and equipment necessary to conform to the above requirements at no additional cost.
2. The Contractor shall be held responsible for the operation, maintenance and repairs of the bridge components from the start of the project to the final acceptance. The Contractor shall also be responsible for maintaining all bridge/roadway lighting fixtures as specified under other pertinent sections.
3. The maintenance shall include regular greasing, fluid change, electrical control maintenance and repairs to any breakdowns during the construction period. Snow plowing and salt spreading will be done by the State, but the snow accumulated near the gates, which may obstruct the operation of the gates, should be cleared away by the Contractor.
4. The Contractor, in the presence of the Engineer, shall examine all the required facilities on the bridge and he shall note items requiring modification and repair prior to the start of mandated maintenance. Upon receipt of a listing of non-operating items the Engineer will make arrangements with the Contractor or other parties to repair mal/non-functioning items. The Contractor shall be required to provide, at no additional cost to the State, temporary power for bridge facilities. When and if needed, temporary power shall be provided by the Contractor at no additional cost to the State.

B. Construction Scheduling

1. The disconnecting and removal of existing facilities, the modification or rehabilitation of other existing equipment, the installation of new apparatus and equipment and the connections of all existing and new apparatus shall be coordinated with the structural, architectural, and

mechanical work under this contract and shall be done in conformance with the requirements governing the sequencing and scheduling of construction as shown on the Plans and specified herein. Component sizes must be coordinated with existing or proposed access to their installed or temporary locations.

2. The Contractor shall prepare and maintain an updated progress schedule to indicate phases of work. The schedule shall be submitted to the Department for review and approval prior to the start of work.

C. Connections to Existing Facilities

1. The Contractor shall make all connections required between the rehabilitated and new equipment and the existing circuits and apparatus to provide for proper operation of the span and its auxiliary equipment, in accordance with the requirements specified herein.

D. Cutting, Patching and Miscellaneous

1. The contractor shall perform all necessary drilling, cutting, and patching required installing his work. All cutting of concrete, structural steel, sidewalks, floor slabs, walls, and other portions shall be done by skilled personnel. All conduits and pipe sleeves shall be properly grouted in the mortar.
2. After completion of the work, the Contractor shall repair all damage caused by his installation or removal of items and shall finish the job in a workmanlike manner satisfactory to the Engineer. Holes in the walls, ceiling, or floor shall be patched and finished to match the existing surfaces. Painted surfaces shall be repainted after being repaired. Any damage to windows, window framing, sash, sills, frames or any other architectural trim shall be repaired by to Contractor at his own expense.

E. Factory Inspection and Testing

1. The control and power distribution cabinets, motor drive cabinets, control console, and other apparatus fabricated or assembled by the control system vendor shall be subjected to shop inspection to demonstrate compliance with all specified requirements. The inspection is intended as a means of facilitating the work and avoiding errors, and it is expressly understood that it will not relieve the Contractor of responsibility for imperfect material or workmanship.
2. The control cabinets, control console, and enclosures control and power equipment with all required interfacing equipment shall be assembled and temporarily interconnected for operational testing at the plant of the control system vendor. The testing shall demonstrate proper operation of all bridge drives and auxiliary equipment in accordance with specified requirements for system functioning, including the vector-controlled motor drives, and all control relays and motor starters.

3. The manufacturer's standard testing shall comprise at least the following:
 - a. Inspection of materials and fit of parts, finishes, adjustments, and conformance with catalog cuts.
 - b. Wire continuity tests, either visual or verified with continuity tester.
 - c. Operational check of circuits to determine proper interlocking of control circuits and operator's devices.
 - d. Polarity of connections to instruments and controls such as skew indicating meters, position indicators, and other polarity-sensitive devices.
 - e. Dielectric test in accordance with applicable NEMA standards.
4. The Engineer or his authorized representative shall witness the factory inspection and special testing required herein, and no equipment shall be shipped from the factory until it has been released for shipment by the Engineer. The Contractor shall provide notification thirty (30) days in advance of the date of the tests so that arrangements can be made for the Engineer to be present at the tests. The Contractor shall submit to the engineer for review, ten (10) days prior to the testing date, a copy of all standard and all special tests to be performed, as well as actual test forms.
5. During the witnessed inspection, nameplate legends, conductor identifications, instrument scales, escutcheon plate engraving, and all other details of construction shall be checked for conformity with specified requirements.

F. Material Installation/Entry Clearance

1. To facilitate installation of the electrical and electrical related assemblies, the Contractor shall review all drawings to ensure that adequate installation space is available. Review of space installation shall be provided prior to manufacture or purchase. Units too large to fit through or into available space shall require the Contractor to enlarge the opening, relocate or re-package the internal equipment at no additional expense to The Department.
2. The Contractor shall arrange, furnish, and install hoisting equipment to facilitate installation and removal of various items. The Contractor shall ensure that the hoisting device has sufficient capacity to raise and lower the loads.
3. The existing west and east elevators shall not be used under any circumstance in the hoisting and installation work to remove any equipment including the span motor, brakes, cabinets, enclosures, and all other associated equipment.

G. Manufacturer's Field Start-Up Service and Testing

1. Included with the furnishing of the major items of electrical equipment by the manufacturer shall be the furnishing of all necessary field supervisory start-up time by the manufacturer's service engineering department to facilitate proper adjustment of the drive equipment so as to achieve satisfactory functioning of the drives.
2. The manufacturer's field service engineering personnel shall be experienced in the adjustment and functioning of the particular control equipment furnished by the manufacturer. The personnel shall be capable of locating and correcting faults or defects and of obtaining from the manufacturer, without delay, new parts or replacements for apparatus that, in the opinion of the engineer, does not perform satisfactorily.

H. Field Testing

1. The Contractor shall arrange for and provide all the necessary field tests, including detailed bridge system acceptance testing, as directed by the Engineer, to demonstrate that the entire electrical system is in proper working order and in accordance with the Plans and Specifications. The tests shall include, but not be limited to, continuity and insulation resistance testing of conductors and operational testing of traffic signals, warning gates, barrier gates, lift span electrical equipment, conduit and wiring, navigation lights, signals, service automatic transfer switch, and complete control system. The Contractor shall arrange with the local power company, ComEd, to obtain, at his own expense, electric power during the testing period until the bridge has been accepted.
2. Should the acceptance tests show that any piece of equipment, cable or wiring connection, and interlocking, in the judgment of the Engineer, is defective or functions improperly; such adjustments and/or replacements shall be made by the Contractor as to make the installation satisfactory to the Engineer and at no extra cost.
3. The Contractor shall obtain final approval of the Operation and Maintenance Manual from the Engineer prior to the final acceptance testing of the bridge.
4. Other field tests for specific equipment shall be as specified in the various sections of these Specifications.

I. Electric Service

1. Existing
 - a. Electric power for the operation of the bridge and its auxiliaries is supplied by Chicago Transit Authority (CTA) from existing 600 V dc service feeders that terminate at the existing DC switchboards located in the East Side and West Side Bridge Control Rooms.

- b. Utility electric power for operation of the bridge facilities and its auxiliaries is supplied by ComEd. Existing 208 V ac, three-phase, 60 Hz service feeders terminate at the East Side and West Side Bridge houses.

2. New

- a. The new electric power service for the bridge and its auxiliaries will be supplied by Commonwealth Edison (ComEd) at 480 V ac, three-phase, 60 Hz as normal power source. Outdoor utility medium voltage switchgear and power distribution step-down transformer shall be furnished and installed by ComEd at a location in the vicinity of the East Side Bridge House. Contractor shall provide concrete foundation for the distribution equipment. Contractor shall coordinate the installation requirement with ComEd for utility furnished equipment.
- b. The service installation shall consist of all material and labor required to extend, connect or modify the electric services, as indicated or specified, which is over and above the work performed by the utility. Unless otherwise indicated, the cost for the utility work, if any, will be reimbursed to the Contractor separately under ELECTRIC UTILITY SERVICE CONNECTION. This item may apply to the work at more than one service location and each will be paid separately.
- c. The electric utility service connection by ComEd shall consist of payment for work by ComEd in providing or modifying electric service as indicated. THIS MAY INVOLVE WORK AT MORE THAN ONE ELECTRIC SERVICE. It shall be the Contractor's responsibility to contact ComEd. The contractor shall coordinate his work fully with the ComEd both as to work required and the timing of the installation. Please contact ComEd, New Business Center Call Center, at 866 NEW ELECTRIC (1-866-639-3532) to begin the service connection process. The Call Center Representative will create a work order for the service connection. The representative will ask the requestor for information specific to the request. The representative will assign the request based upon the location of the project. The Contractor should make particular note of the need for the earliest attention to arrangements with ComEd for service. In the event of delay by ComEd, no extension of time will be considered applicable for the delay unless the Contractor can produce written evidence of a request for electric service within 30 days of execution.
- d. A standby emergency packaged engine generator set will provide emergency power source in the event of loss of normal power. An Automatic Transfer Switch (ATS) will automatically transfer from

normal power source to emergency power source upon loss of normal power. Upon return of normal power, the ATS will automatically return to normal power source.

J. Power Distribution

1. The 480 V ac service entrance disconnect shall feed the Main Switchboard which in turn distribute the Motor Control Center (MCC) as shown on the Plans. In the event of failure of the normal feeder source, the automatic transfers switch shall operate automatically to connect the emergency generator to the power distribution system. Sub-feed circuit breakers, starters and other power and control devices in the MCC shall distribute power to all motors and controls for operation of the bridge, auxiliaries, and lighting systems.

K. Automatic Transfer Switch (ATS)

1. The ATS shall provide the function of transferring the service load from the normal source feeder to the emergency source feeder while continuously monitoring the power system parameters on both the normal and emergency sources.
2. A detailed description of the ATS is provided under the Specification's Special Provisions Section "Automatic Transfer Switch".

L. Lighting and Power Transformer

1. Electrical ratings:
 - a. Number of phases 3
 - b. Frequency 60 Hertz
 - c. KVA Rating As shown on Plans
 - d. Primary Voltage 480 V Δ
 - e. Secondary Voltage 208V/120V Y
 - f. Minimum Efficiency 95%
 - g. Type Dry-Type
2. Transformer windings shall be of copper, shall be of continuous wound construction, and shall be impregnated with non-hygroscopic, thermosetting varnish. Transformers shall have a minimum of five (5) -2.5% full capacity primary taps for 480V primary, with four (4) taps below normal to properly compensate for voltage drop. Exact voltages and taps to be as designated on the Plans or the transformer schedule.

3. Transformer insulation shall be a UL recognized minimum 150°C system (temperature rise). Neither the primary nor the secondary temperature shall exceed 150°C at any point in the coils while carrying their full rating of sinusoidal or non-sinusoidal load.
4. The core flux density shall be well below the saturation point to prevent core overheating. Transformers shall be common core construction. Transformers utilizing more than one core, or Scott-T connections, shall not be acceptable.
5. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635. The enclosure shall be made of heavy-gauge steel. The transformer shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.
6. The enclosure construction shall be encapsulated, totally enclosed, NEMA 3R. Enclosures shall be finished with ANSI 61 color, weather-resistant enamel.
7. Install transformers as indicated in accordance with:
 - a. Manufacturer's written instructions
 - b. Applicable requirements of NEC standards
 - c. NECA 409-2002, Recommended Practice for Installing and Maintaining Dry-Type Transformers (ANSI)
8. Tighten connectors and terminals including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's tensioning requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
9. Fasten enclosure firmly to the floor and structural surfaces, ensuring that they are permanently and mechanically anchored. Provide equipment grounding connections for the transformer as required.
10. Provide liquid tight flexible connections to the conduit runs as indicated in these Special Provisions.
11. The transformer shall be Square D 45T2F, Cutler-Hammer or Engineer approved equal.

M. Grounding and Bonding

1. The bridge steel work on each side of the channel and the bridge house shall be solidly bonded and grounded to ground rods installed in the west and east piers and at the bridge house, using No. 2/0 AWG bare, stranded, tinned copper cable.
2. Exothermic welds shall be used to connect ground conductors to ground rods and ground bus bars. The resistance to ground shall be no less than 5 ohms. Exothermic welds shall be molded fusion, type as required, as manufactured by Cadweld, Thermoweld, Metalweld, or approved equal. A minimum of one ground rod at the pier and one ground rod in proximity to the traffic control devices (warning gates, barrier gates) shall be furnished and installed on both the west and east bridge approaches.
3. Traffic signal poles, warning gates, barrier gates, standby generator neutral conductor and engine block, grounding conductors in conduits, navigation lighting units, all metal framing, cases, and enclosures of the electrical equipment, such as motors, control desk, control cabinets, boxes, and all other metal parts in the proximity of current carrying conductors or equipment shall be bonded together and solidly connected to a ground bus in the switchboard room, and another ground bus in the generator room. All electrical equipment ground buss work shall be connected to the closest ground rod and to the tower metal structure.
4. The bridge grounding conductor and grounding electrode conductors shall be electrically connected through exothermically welds and bonds.
5. Grounding system terminals shall be solderless lugs and shall be secured by means of hexagonal-head, copper plated, steel machine bolts with lock washers or lock nuts. Ground system conductors shall be continuous unspliced connections between terminal lugs. Paint, rust, and scale shall be removed over the contact area. All connections shall be made up as tightly as possible and any bare metal or paint undercoat remaining exposed shall be spot painted to restore the surface with the same coating and number of coats as applied to the adjacent metal. Bolted connections shall be restricted to removable items (e.g., motors).
6. Equipment ground conductors shall be seven-strand, soft-drawn, bare, tinned copper wire conforming to ASTM B33 and not smaller than No. 8 AWG.
7. Ground rods shall be made of copper or copper-clad steel and shall not be less than 1 inch in diameter and 10-feet in length unless otherwise specified. A permanent, exothermic weld connection to the permanent steel sheet piling at the bridge towers is an acceptable grounding means at the indicated locations. If the steel sheet piling is not accessible, ground rods shall be used as grounding electrodes. Insulated green ground conductor shall be used when exposed to wet environment.

8. A minimum of two ground rods per pier, west bridge house and east bridge house shall be installed to establish the bridge grounding system. The grounding system connections shall also be used to establish the grounding paths for the lightning protection system as described below,
9. The utility service neutral conductor, if available, shall be grounded in accordance with the utility company's standard requirements.
10. Upon completion of installation of electrical grounding and bonding system's test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over five (5) ohms, reduce resistance to five (5) ohms or less, by driving additional grounding electrodes. The test shall be repeated to demonstrate compliance.

N. Main Leaf Drive Motors

1. The main leaf drive motors are specified under the Specifications Special Provisions Section "Main Leaf Drive Motors".

O. Main Leaf Motor Drives

1. Furnish and install a Vector-controlled Motor Drive system in the number and voltages shown on the plans and with the current ratings according to application requirements. The system must be specifically manufactured for the movable bridge industry.
2. Detailed description and requirements for the vector-controlled motor drive is specified under the Specification's Special Provisions Section "Vector-Controlled Motor Drives.

P. Provision for Gate Motors and Controls.

1. Electric motors for operation of the barrier gates shall be furnished as part of the barrier gate machinery by the gate manufacturer and shall be installed under the Specification Special Provision Section "Retractable Barrier Gates".
2. Each barrier gate motor (total of four motors) shall be a weatherproof, totally enclosed non-ventilated (TENV), 460-volt, three-phase, 60 Hertz, ball-bearing, squirrel cage motor capable of withstanding instant reversal when running at full speed. Each barrier gate motor shall be provided with a brake for stopping and holding the mechanism.
3. Each barrier gate motor shall be controlled by variable frequency drive, electrically and mechanically interlocked, and shall be protected by a three-element, thermal overload relay, automatic reset.

4. Each gate – four pairs of traffic gates and two barrier gates – shall be operated from individual raise and lower pushbuttons on the control console. Pushbutton circuitry shall be arranged such that the gate in motion will stop immediately when the pushbutton is released. In addition, the group of four traffic gates shall be provided with a group raising pushbutton, and the two barrier gates shall be provided with a group raising pushbutton. All gates in a group shall travel to their respective limits after a momentary raise command of the group switch. The group shall stop immediately upon momentary contact of the group's respective stop pushbutton. The push-to-stop lamp shall illuminate when gates are in motion. When gates are in motion the raise or lower light will flash. When gate has been fully raised/lowered the light will be constantly illuminated.
5. All electrical work to provide for the connection, operation, and control of the gate motors, including control apparatus, switches, conduits, boxes, cables, and other equipment, shall be furnished and installed under this item of "Electrical Work." The work shall also include adjustment of all apparatus and overload devices to provide proper functioning of the equipment.
6. Each barrier gate furnished under the item of "Retractable Barrier Gates" shall include a 120/12-volt flasher and gate lights, a limit switch built into the gate housing. The limit switch shall provide contacts to control the limit of travel in each direction and for indication and sequence interlocking. Adjustment of gate crank arms and limit switches for proper operation shall be done under the item of "Barrier Gates."
7. Each traffic gate furnished under the item of "Traffic Gates" shall include a 120/12-volt flasher and gate lights, a limit switch built into the gate housing. The limit switch shall provide contacts to control the limit of travel in each direction and for indication and sequence interlocking. Adjustment of gate crank arms and limit switches for proper operation shall be done under the item of "Traffic Gates."

Q. Motor Tests.

- a. A complete set of speed-torque-current curves for the span motors shall be prepared and submitted to the Engineer for approval. Motor current and torque curves corresponding to full speed, three quarter speed, half speed, quarter speed, and no-load speed shall be provided at rated voltage. The curves shall cover the interval from 200 percent braking torque to breakdown driving torque (for AC motors), referred to as full-load motor torque.
- b. The span motor and spare shall include a megger test. Insulation resistance values and test voltage values shall be included on the test report. Testing shall be between each lead and ground.

- c. Tests shall be reported on the standard forms for induction motors of the National Electrical Manufacturers Association MG-1 and IEEE 112. All test reports and curve sheets shall be certified by the manufacturer, and seven copies of each shall be submitted. Motors shall not be shipped from the plant of the manufacturer until the test reports have been approved by the Engineer.

R. Motor Control Center (MCC)

1. The Motor Control Centers (MCC's) shall include, but not be limited to, all parts, materials and associated appurtenances described below, such as MCC enclosures, covers, wireways, mounting hardware, motor control and protection devices.
2. The MCC's shall be constructed to meet or exceed the requirements within NEMA ICS-2 and UL845 for motor control centers. The MCC's shall be designed, manufactured, and tested in facilities registered to ISO 9001 quality standards. The MCC enclosures shall be NEMA/EEMAC Type 12 rated.
3. Ratings
 - a. The Motor Control Center(s) shall be 600 Volt class suitable for operation on a three-phase, 60 Hz system. The system operating voltage and number of wires shall be as indicated on the Plans.
4. Construction
 - a. The MCC shall consist of multiple vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly. The entire assembly shall be constructed and packaged to withstand all stresses included in transit and during installation.
 - b. Structures shall be totally enclosed dead front, free-standing assemblies. They shall be no more than 90 inches high and 21 inches deep. Structures shall contain a horizontal wireway at the top, isolated from the horizontal bus and shall be readily accessible through a hinged cover. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference.
 - c. Structures shall be totally enclosed, dead-front, free-standing assemblies. Structures shall be capable of being bolted together to form a single assembly. The total width of one section shall be 20 inches. Widths of 25 inches, 30 inches, and 35 inches can be used for larger devices.

- d. Each 20-inch wide standard section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters.
- e. A vertical wireway with minimum of 35 square inches of cross-sectional area shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain steel rod cable supports.
- f. All full voltage starter units shall be of the drawout type. Drawout provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Drawout units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend into the bus compartment. Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted, positive latch pull-apart type control terminal blocks rated 600 volts. Knockouts shall be provided for the addition of future terminal blocks. All control wire to be 14 AWG SIS type.
- g. All drawout units shall be secured by a fastening device located at the front of the unit. Each unit compartment shall be provided with an individual front door.
- h. An operating mechanism shall be mounted on the primary disconnect of each starter unit. It shall be mechanically interlocked with the unit door to prevent access unless the disconnect is in the OFF position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal or reinsertion of the unit while in the ON position. Padlocking facilities shall be provided to positively lock the disconnect in the OFF position with from one (1) to three (3) padlocks with the door open or closed. In addition, means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.
- i. **Bus**
 - a. Each structure shall contain a main horizontal copper tin-plated bus, with minimum ampacity of 600 amperes as shown on the drawings. The horizontal bus shall be rated at 65 degrees C temperature rise over a 40 degree C ambient in compliance with UL standards. Vertical bus feeding unit compartments shall be copper and shall be securely bolted to the horizontal main bus. All joints shall be front-accessible for ease of maintenance. The vertical bus shall be fully rated 600 amperes.

- b. The vertical bus shall be completely isolated and insulated. It shall effectively isolate the vertical buses to prevent any fault-generated gases to pass from one phase to another. The vertical bus shall include a shutter mechanism to provide complete isolation of the vertical bus when a unit is removed.
- c. Buses shall be braced for 65,000 amperes rms symmetrical. A copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the MCC. Each structure shall contain tin plated vertical ground bus rated 300 amperes. The vertical ground bus shall be directly connected to the horizontal ground bus via a tin-plated copper connector. Units shall connect to the vertical bus via a tin-plated copper stab.

6. Combination Starters and Contactors

- a. All combination starters shall utilize a unit disconnect. Magnetic starters shall be equipped with double-break silver alloy contacts. Each starter shall have one (1) NO auxiliary contact or as indicated on the plans. All coils to be color-coded through size 5 and permanently marked with voltage, frequency and part number.
- b. All starters shall be provided with overload relays. Overload relays shall be an ambient compensated bimetallic-type with interchangeable heaters, calibrated for 1.0 and 1.15 service factor motors. Electrically isolated NO and NC contacts shall be provided on the relay. Visual trip indication shall be standard. A test trip feature shall be provided for ease of troubleshooting and shall be conveniently operable without removing components or the motor starter. Overload to have (+/-) 24% adjustability, single-phase sensitivity, and isolated alarm contact. Overload relays shall have manual or automatic reset.
- c. When provided, control circuit transformers shall include primary protection and one secondary fuse in the non-ground secondary conductor. The transformer rating shall be fully visible from the front when the unit door is opened.
- d. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.
- e. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.

- f. Minimum starter and contactor size shall be NEMA Size 1.
- g. Motor starters and contactors shall be Cutler-Hammer Freedom Series, Square D type S series, or Engineer approved equal.

7. Accessories

- a. Motor starters and contactors shall be designed to accommodate two (2) auxiliary contact blocks, each capable of a combination of up to four (4) normally closed or four (4) normally open auxiliary contacts. Contacts to be color-coded; black designating NC and silver designating NO. Contacts to be rated ten (10) amperes continuous, 7200 VA make, 720 VA break for 120 through 600V AC, and 69 VA make and break for 125 through 300V DC. Provide a minimum of one (1) spare NO contact and one (1) spare NC contact in addition to any auxiliary contacts required.
- b. Provide a mechanical interlock on reversing or multispeed contactors of the lever-type mechanism (with electrical contacts included) to prevent closing of one contactor when the other is closed.

8. Over current Devices

- a. Circuit Breakers
- b. Individual feeder breakers shall have a minimum interrupting capacity of 65 kAIC at rated voltage or as shown on the plans.
- c. Fusible Switches
- d. Individual feeder switches shall be quick-make, quick-break gang-operated type utilizing Class R fuse clips. The fused switch shall be rated 100 kAIC at rated voltage.

9. Incoming Feeder Terminations and Devices

- a. Incoming cable shall terminate within the MCC on a main lug or main breaker termination point as shown on the plans. Main lug terminations shall have adequate dedicated space for the type and size of cable used and the lugs shall be compression-type with antiturn feature. Main breakers shall be provided as indicated on the plans and shall be molded case type.

10. Controls, Selector Switches and Pushbuttons

- a. Control switches and pushbuttons shall be heavy-duty, oil-tight contact blocks operated by selector knobs or pushbuttons as

indicated on the plans. Contacts shall be fine silver, capable of interrupting 6 amperes at 120 volts AC and of continuously carrying 10 amperes. Control wiring shall be #14 AWG copper with Type SIS insulation, 90 C rated minimum.

11. Indicating Lights
 - a. Indicating lights shall be heavy-duty, oil-tight sockets provided with 6-watt lamps rated 135 volts. Indicating lights shall be of the "push-to-test" type. All lenses shall be glass, with color and escutcheon plates as shown on the Plans.
12. Nameplates
 - a. Each unit door shall have an engraved acrylic nameplate, white with black lettering. A master nameplate shall be provided on each MCC lineup.
13. Documentation
 - a. Wiring diagrams shall be provided at a centralized location in the MCC. Each modular unit shall also be supplied with wiring diagrams and product data. The diagram shall show the exact devices inside the unit and shall not be a generic diagram.
14. Quality Control
 - a. The entire MCC shall go through a quality inspection before shipment. This inspection will include:
 - b. Physical Inspection of: structure, electrical conductors, including bussing, general wiring, and units.
 - c. General electrical tests including power circuit phasing, control circuit wiring, instrument transformers, ground fault system, and device electrical operation.
 - d. AC dielectric tests of power circuits and control circuits.
 - e. Markings/Labels verification, including instructional type, Underwriters Laboratory (UL), and inspector's stamps.
 - f. The manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that the MCC meets operating specifications.
15. Manufacturers:
 - a. Cutler-Hammer Freedom & Advantage series, Square D Model 6 series, Allen-Bradley

b. Engineer approved equal.

S. Sequence of Operation

1. After a boat signals for an opening, give the necessary signals with the air horns.
2. Turn the bridge control switch to "On."
3. Turn the traffic signals switch to turn from "Go" (green) the traffic lights to "Stop" (red), and turn on the warning drawbridge signs on the west and east approaches. After a short time delay of six (6) seconds, the transition amber traffic signal lights shall be extinguished and the red traffic lights, gate warning lights, and gongs turned on.
4. Lower the traffic gates for oncoming traffic one approach at a time.
5. Lower barrier gates in the proper sequence. Gongs will shut off when all gates are lowered.
6. Withdraw the span locks. Main motor drives are enabled when span locks are withdrawn.
7. Raise the span to the fully open position; span navigation lights will turn from red to green.
8. After the boat has passed, sound horn and lower the span, bringing it to a full seat at all corners.
9. Drive the span locks. Barrier gates are enabled when the span locks are driven.
10. Raise barrier gates by means of the group raising or individual control. Gongs will begin ringing again.
11. Raise the traffic gates by means of the group raising control.
12. As soon as all traffic gates are raised, turn the traffic signals to "Green." Gongs will stop ringing. Bridge traffic signal will turn green and the warning drawbridge signs will turn off.
13. Turn bridge control switch to "off."

T. Interlocking

1. The various control operations shall be so interlocked that they can be performed only in their proper sequence and that no damage can result from an incorrect operation. This interlocking shall be arranged as follows:

- a. Contacts of the gate limit switches shall be so arranged that movement of any gate from its fully raised position (lower than 85 degrees) shall turn on the red traffic signals, advance warning lights, and gongs.
- b. As soon as the traffic gates are fully raised (after any one of them has been partly or fully lowered more than 85 degrees), the "Red Signals Ahead" signs, red traffic lights, warning lights, and gongs shall be turned off, provided the traffic signals switch has been returned to "Go."
- c. The traffic gates cannot be operated electrically unless the bridge control is turned on, the "Stop" traffic signals are red, and all barrier gates are fully raised.
- d. The barrier gates cannot be operated electrically unless the "Stop" traffic signals are red, and the warning gates are down.
- e. The span cannot be operated electrically unless all traffic gates and barrier gates are down, and the traffic signals are red.
- f. Sealed tumbler switches for bypassing the sequence interlocks in an emergency shall be provided and installed on the control console as shown on the Plans. Provision shall be made so that each bypass switch can be locked in the "Off" position by means of a lockable brass cover plate.

U. Drive Speed Feedback Equipment

- i. The AC motors shall be provided with a unit assembly of overspeed switch for use in conjunction with the drive systems. The assembly is a mechanical device consisting one (1) Euclid type speed responsive switch, and shall be supplied by the control system integrator. Each unit assembly shall be enclosed in NEMA 3R housing, installed on a suitable motor mounted bracket and coupled directly to the motor shaft. The over speed switch unit is a centrifugally operated electric switch which is used for overspeed protection. The switch contact shall be set at a low over speed check rpm for over speed condition during deceleration speed operations.
- ii. The AC motors shall be retrofitted with new dual output, bearingless, heavy-duty encoders, furnished and installed as shown on the Plans. The encoders shall be of the industrial type (aluminum and glass encoder wheels are not acceptable). The encoders shall be quadrature type with a resolution of 1024 ppr and be compatible with the drives. It shall be installed on the motor as applicable to each AC motor particular configuration. The Contractor shall be responsible for the field verification of the encoder retrofit installation.

V. Control Apparatus and Miscellaneous Equipment

1. Control apparatus shall conform to the applicable requirements of NEMA Publication No. ICS, latest revision, Industrial Control and Systems, rated as shown on the Plans or as required and to the following:
 - a. Circuit Breakers: All branch circuits where shown on the Plans shall be protected by molded-case circuit breakers mounted on the control panels. All breakers shall have quick-make and quick-break contacts, and the mechanism shall be trip-free and trip-indicating. Frame sizes shall not be less than 100 amperes and as shown on the Plans. The breakers shall be equipped with thermal-magnetic trips or adjustable, instantaneous, magnetic trip units, with trip rating as shown on the Plans or as required. Molded-case circuit breakers shall meet the requirements of NEMA Publication No. AB1, latest revision. The generator disconnect circuit breakers (CB-GEN) shall be 200 Ampere frame size, 600 volt rated, with 225 Ampere electronic trip unit with independently adjustable short time pick-up and time delay, set to trip at 200 Amperes. Interrupting capacity shall be no less than 100,000 AIC. Circuit breakers shall be furnished with N.O./N.C. format.
 - b. Motor Circuit Protectors: All branch circuits, where shown on the Plans, shall be protected by instantaneous trip motor circuit protectors (MCP). The MCP shall comply with UL 489 and IEC 157.1. The MCP shall be marked to permit proper electrical application within the assigned equipment ratings. The MCP shall be F-frame, 480 VAC maximum with alternate cam setting provision as manufactured by Cutler-Hammer, Square D FAL-frame, or Engineer approved equal.
 - c. Motor Starters and Magnetic Contactors: The continuous current rating of contactors and starters shall be adequate for the connected loads, and no starters shall be smaller than NEMA Size 1. All contact poles shall be provided with arc chutes, and contactors rated 150 amperes and above shall be equipped with magnetic blowouts. Contactors and overload relays shall be provided with a minimum of one normally open auxiliary contact and one normally closed auxiliary contact. Three-element, automatic reset, overload relays shall be provided for motor protection. Reversing contactors shall be electrically and magnetically interlocked.
 - d. Motor Disconnect Switches: Unfused safety switches for use as disconnects, shall be installed within the range of view of each motor. The switches shall be lockable, non-fusible, heavy-duty, safety switches, rated as shown on the Plans, and in watertight

and dust-tight NEMA 4X, stainless steel enclosures. Each disconnect shall be furnished with a N.O. /N.C. auxiliary contact and phenolic nameplate to identify corresponding motor or brake.

- e. Overload Relays: Manual reset overload relays shall be provided to protect the brake motors, controllers, and wiring against overheating due to excessive current. Automatic reset overload relays shall be provided for span motor and gate motors. Heater elements are to be selected based on motor full-load running current. Each O.L. shall provide a N.O. and N.C. contact.
- f. Over current Relay: Adjustable magnetically-operated/overload relay. Relay furnished with adjustable tripping current and tripping time and automatic reset used for synchro-tie operation and should be set to trip at 180 percent full load current.
- g. Control Relays: Auxiliary control relays shall be multi-contact magnetic relays with contacts rated at 10 amperes, 600 volts, on a continuous basis. Relays that meet the specified requirements are the Square D 8501 Class X, Allen Bradley Bulletin 700 Type P, General Electric CR120B or Engineer Approved Equal.
- h. Industrial Alternating Control Relays: Alternating relays shall be multi-contact magnetic relays with contacts rated at 10 amperes, 600 volts on a continuous basis. Alternating relays that meet the specified requirements are the Square D CA2SKE or Engineer approved equal.
- i. Timing Relays: Time-delay relays shall be of the electro-pneumatic type providing time delay intervals as required with a linear timing range in the ratio of 1:10. Each timing relay shall be provided with a timing head calibrated in linear increments. The number and type of poles shall be as shown on the Plans.
- j. Phase Failure and Reversal Relay: This relay shall prevent energizing the bridge controls in the event of reversed phase sequence, loss of one phase, or low voltage. Equipment that meets the specified requirements includes the Square D type MPD, Cutler Hammer Type D65, or Engineer approved equal.
- k. Selector switches and Pushbuttons: Control switches and pushbuttons on the control console shall be heavy-duty, oil-tight contact blocks operated by selector knobs or pushbuttons as indicated on the Plans. Contacts shall be fine silver, capable of interrupting 6 amperes at 120 volts A-C and of continuously carrying 10 amperes.

- i. **Indicating Lights:** Indicating lights shall be heavy-duty, oil-tight sockets provided with 6-watt lamps rated 135 volts. Indicating lights shall be of the remote test type. All lenses shall be glass or plastic, with color and escutcheon plates as shown on the Plans. Indicating lights shall be Cutler-Hammer 22.5 mm industrial heavy-duty type E22 or Engineer approved equal.
- m. **Terminal Blocks:** Terminal blocks for conductors of Size No. 8 AWG and smaller shall be one-piece blocks of phenolic material recognized under the UL Component Recognition Program. Barriers shall be not less than 1/2 inch high and 1/8 inch thick and shall be spaced 5/8 inch center-to-center. Straps and screws shall be of brass; nickel plated for use in highly corrosive atmospheres, and shall be rated for 50 amperes. The blocks shall provide a withstand voltage rating of 750 volts per IEEE switchgear standards. The terminal blocks shall provide strap screws suitable for use with ring tongue wire connectors. Corrosion resistant marking strips shall be provided for conductor identification. At least ten percent spare terminals shall be provided for use with power conductors and twenty percent for use with control conductors. Terminal blocks shall be Buchanan Type 2B112, General Electric Series CR 151B, Marathon series 1600 or Engineer approved equal. Screws shall be nickel plated brass construction.
- n. **Power Distribution Blocks:** Power distribution blocks, for all conductors larger than No. 8 AWG, shall be constructed from a single piece of hard-drawn copper, machined and electro-tinned. All blocks shall be mounted on heavy-duty phenolic material and furnished with safety cover kits. Number and size of primary and secondary wire openings will be selected by the Contractor/Vendor and shall be approved equal to the 66000 series blocks as manufactured by Gould Shawmut or Series 145 by Marathon.
- o. **Nameplates:** Nameplates shall be provided for all aforementioned devices and shall be made of laminated phenolic plastic with white front and back and black core and shall be not less than 0.094 inch thick. The lettering shall be etched through the front layer to show black engraved letters on a white background. Lettering shall be not less than 1/4 inch high, unless otherwise detailed on the Plans. Nameplates shall be securely fastened to the equipment with stainless steel screws.

W. **Equipment Labels**

- 1. All electrical devices such as disconnect switches and cabinet equipment shall have a label affixed to each unit. The label shall be similar in construction to the aforementioned nameplates. Each label shall be of

suitable size and letter characteristics. Text shall indicate name/function of each item. Disconnect switches shall provide a label indicating the voltage within. Labels shall be securely attached using stainless steel screws. The Contractor shall submit to the Engineer for review, all signs, with sizes, location and text.

X. Existing Control Desk

1. The existing control desk including all top metering, indicating and control devices, shall be preserved and protected until such time that new control desk is ready for installation in accordance with the construction staging plan. All existing control desk functions shall be disabled, and the control devices disconnected. All existing control devices, relays and wiring inside the control desk shall be removed as needed.
2. Other Miscellaneous Existing Equipment To Remain

Y. New Control Desks

1. Control desks descriptions are specified in the Specification's Special Provision for "Integrated Bridge Control System".
2. The Contractor shall field verify all dimensions including of the control switches and indicating lights, and locations of the control console prior to submitting any drawings related to the control desk construction.
3. Bridge control desks shall be furnished and installed in the East Side Bridge Operator's Room as shown on plans. On the control desk shall be mounted all devices for controlling operation of the bascule span and its auxiliaries including all devices for controlling operation of the bridge and traffic control equipment.
4. Special care shall be taken throughout the construction to insure that the control desk top and the equipment mounted thereon are completely protected from damage or defacement at all times.

Z. Raceways/Wireways/Troughs

1. Conduits
 - a. All wiring shall be installed in conduit or wireways.
 - b. The PVC coated rigid metal conduit must be UL listed. 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 must be UL listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Fittings for Conduit and Outlet Boxes.

- c. The conduit shall be hot dip galvanized inside and out with a clear urethane coating over hot galvanized threads.
- d. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
- e. The PVC coating on the outside of the conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- f. Form 8 condulets shall be supplied with plastic encapsulated stainless steel cover screws.
- g. A green 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. Conduit or fittings having areas with thin or no coating shall be unacceptable.
- h. 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 30°F (-1°C).
- i. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
- j. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
- k. Independent certified test results shall be available to confirm coating adhesion.
- l. All conduits shall be standard weight, threaded, rigid steel conduit conforming to the requirements of ANSI Standard C80.1. All conduits shall be hot-dip galvanized, inside and out, to meet the requirements of the above standard for protective coating. Conduit couplings and fittings shall be made of malleable iron or steel, hot-dip galvanized.
- m. All conduits to be installed in outdoor locations shall be plastic coated. Conduit fittings, including couplings, unions, elbows, expansion and deflection fittings, and other items, shall also be plastic coated. Conduits and fittings, which are to be plastic coated, shall be provided with a factory applied polyvinyl-chloride (PVC) coating. This internal coating shall be sufficiently flexible so as to permit field bending without cracking or flaking. The PVC coated, hot-dip galvanized steel conduit shall be UL labeled and listed. Conduits that meet above requirements are manufactured by Perma-Cote, Robroy, or Engineer approved equal.

- n. All hollow conduit and fittings that serve as part of the raceway shall be coated with the same exterior PVC coating and interior urethane coating. The plastic interior coating and the interior urethane coating shall be factory applied by the same manufacturer who produces the hot-dip galvanized conduit. PVC coated conduit shall be installed in accordance with the manufacturer's installation manual and shall be certified by the manufacturer or their certified representative.
- o. Unions to connect sections of conduit that cannot be joined to each other or to boxes in the regular manner shall be of malleable iron or steel, hot-dip galvanized, PVC coated.
- p. Conduits shall not be less than 3/4 inch in diameter. The interior surfaces shall have a smooth finish and be free of burrs or projections, which might cause injury to the cables. All conduits shall be free from blisters, cracks, or injurious defects and shall be reamed at each end after being threaded. Sections shall be connected to each other with screw couplings made up so that the ends of both conduits will butt squarely against each other inside of the coupling. Conduits shall be installed so as to be continuous and watertight between boxes or equipment. Conduits shall be protected at all times from the entrance of water or other foreign matter by being well-plugged overnight or when the work is temporarily suspended.
- q. Conduit bends and offsets shall be made by cold bending using approved methods and equipment. The use of a pipe tee or vise for bending conduit will not be permitted. Conduit that has been crushed, or in any way deformed, shall be discarded. All bends shall be long sweep, free from kinks, and of such easy curvatures as to permit the drawing of conductors without injury. Conduit runs shall be made with as few couplings as standard lengths will permit, and the total angle of all bends between any two boxes or cabinets shall not exceed two quarter bends, unless otherwise approved by the Engineer. The radius of curvature of pipe bends shall not be less than eight times the inside diameter of said conduit. Long running threads will not be permitted. Pull boxes shall be used whenever necessary to facilitate the installation of the wire.
- r. Except for installation indoors in the control house or where specifically permitted by the Engineer, condulets shall not be used for pulling conductors or for making turns in conduit runs or for branching conductors. Condulets, where permitted, shall consist of malleable iron castings with gasketed covers of the same material and fastened with brass cover screws. The bodies shall be hot-dip galvanized.

- s. All new conduits shall, wherever practicable, be concealed in the walls, ceilings, or floors. Where conduits pass through the floors or walls of the houses, they shall be cast-in-place, or they shall be provided with galvanized pipe sleeves for free passage of the conduits. After the conduits are installed, the openings shall be caulked with an elastic compound and escutcheon plates provided on the interior walls, ceilings, and floors.
- t. Conduits shall be securely clamped and supported at intervals not exceeding 5 feet in length, or other supporting lengths approved by the Engineer.
- u. Conduit runs exposed on the steel structure shall be securely clamped to the steel work. The clamps, in general, shall consist of PVC coated U-bolts attached to structural steel supports bolted to the members. The minimum thickness of the structural supports shall be 3/8 inch. Supports shall be arranged so that conduits rest on top of the support and U-bolts rest on top of the conduits. The use of J-bolts to fasten structural supports or to clamp conduits will not be permitted.
- v. All U-bolts shall be provided with medium-series lock washers and hexagonal nuts. The bolts, nuts, and washers shall be of stainless steel conforming to the requirements of the Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes, ASTM Designation A276, Type 316. U-bolts used for securing PVC coated conduits shall be manufactured from stainless steel with PVC coating.
- w. Where conduits are to be mounted exposed on non-steel surfaces, they shall be securely clamped to the surface using bent plate pipe supports with back spacers held by not less than two bolts. The stock size for the bent steel plate supports shall be 1/4 inch thick by 2 inches wide. Back plates shall be of 3/8-inch thick steel. Supports and spacers shall be hot-dip galvanized. Bolts shall be not less than 1/2 inch in diameter and shall be of stainless steel conforming to the requirements specified for U-bolts.
- x. At any point where a conduit crosses an expansion joint longitudinally or where movement between adjacent sections of conduit can be expected, conduit expansion fittings shall be installed. The fittings shall be bronze expansion fittings and shall be provided with flexible bonding jumpers to maintain the electrical continuity across the joints. The fittings shall permit a total conduit movement of 8 inches and shall be approved equal to the O.Z. Gedney Type AX, Spring City Type EF, or Engineer approved equal.

- y. At any point where a conduit crosses a joint laterally or where an offsetting type movement between adjacent sections of conduit can be expected, expansion and deflection fittings shall be installed. The fittings shall permit a movement of 3/4 inch from the normal in any direction. The fittings shall be the O.Z. Gedney Type DX, Spring City Type EDF, Adalet Type STX, or approved equal.
- z. Flexible conduits for the connections between the rigid conduit system, all motors, and limit switches shall be made with sections of PVC coated, flexible, metallic, liquid tight conduit. Each section shall not exceed 18 inches without prior approval of the Engineer.
- aa. All conduit embedded in concrete, insofar as possible, shall be completely encased by concrete of not less than 3 inches, measured in any direction, and shall be securely held in place during pouring and construction operations. A group of conduits terminating together shall be held in place by a template.
- bb. All conduit and fittings shall be carefully examined before being installed, and all pieces having defects shall be set aside and removed from the site. All bends shall be made with standard size conduit elbows. Bends and offsets can be made with a power bender or hicky without kinking or destroying the plastic surface or smooth bore of the conduit when approved by the Engineer. Conduit shall be assembled hand and tight and then using strap wrenches tightened two more turns. Wrench marks or chuck marks shall be touched up with the appropriate touch-up compound. All cuttings and threading shall be performed as recommended by the conduit manufacturer. All conduit, enclosures, and fittings shall be mechanically joined together to form a continuous electrical conductor to provide effective electrical continuity.
- cc. Ends of abandoned conduits, spare conduits, and empty conduits and stubs shall be capped during and after construction, and care shall be taken to ensure that no moisture or other matter is in or enters the conduits.
- dd. All conduits shall be pitched not less than 1 inch in 10 feet (except by special permission). Where conduits cannot be drained to pull boxes, a drain "T" with drain fitting shall be installed at the low point and drained to a 1-cubic foot dry well of broken stone. Drain fittings shall be of stainless steel and shall be capable of passing 25 cc of water per minute.
- ee. The ends of all conduits projecting into boxes and equipment enclosures shall be provided with bronze insulated grounding bushings.

The insulated portion shall be of molded phenolic compound, and each fitting shall have a screw type combination lug for bonding. Insulated bushings shall be the O.Z./Gedney Type RBLG, or Engineer approved equal. All bushing in any box or enclosure shall be bonded together with No. 8 AWG bare copper wire.

- ff. All conduits shall be carefully cleaned both before and after installation. Upon completion of the conduit and box installation, the Contractor shall clear each conduit by snaking with a steel band, to which shall be attached an approved tube cleaner equipped with a mandrel of a diameter not less than 85% of the nominal inside diameter of the conduit and with a wire brush of the same diameter as the conduit, and shall then draw in the cables.
- gg. Both ends of each conduit run shall be provided with a brass tag having the same number stamped thereon in accordance with the conduit diagrams, and these tags shall be securely fastened to the conduit ends with No. 20 AWG brass wire.
- hh. For traffic devices and control and power conduit buried in the earth on the bridge approaches, UL listed PVC Schedule 80 conduit shall be used.

2. Wireways/Troughs

- a. A wireway/trough shall be furnished and installed where shown on the Plans to provide for termination of conduits and to distribute the wiring to the various sections of the control house power and control cabinets.
- b. A drawing showing the assembly and complete construction details of each trough shall be prepared and submitted for approval before each trough is fabricated. The Contractor shall follow the assembly and details of the trough as shown on the Plans.
- c. The wiring trough shall be NEMA 1, 3 or 12, constructed of No. 12 gauge sheet steel with No. 10 Gauge Flanges suitably reinforced with structural steel angels, and welded continuously at all seams and joints. It shall have a gasketed removable cover to provide access to the interior. Covers shall be secured by stainless steel screw clamps spaced no more than 8 inches apart. Wireways/troughs shall be supported every 5 feet. Details for hanging units shall be as shown on the Plans.
- d. The wiring trough shall be painted inside and out with one coat of primer followed by one coat of white enamel on the inside surfaces and two coats of gray enamel on the outside. The finish

coat shall be ANSI 61 Light Gray. Wireways shall be supported from adjacent ceilings using S.S. Hanger Rods and Angles or as shown on the Plans.

- e. All sections of each wireway/trough shall be electrically connected to form an electrical bond and shall be tied to the Bridge Grounding System. Damaged sections if the trough shall be removed, repaired, painted or replaced.

3. Boxes

- a. All boxes shall be sized, at a minimum, as per NEC Article 314. All boxes that contain both power and control conductors shall be provided with dividers. All outside location boxes not buried shall be stainless steel, NEMA 4X, 14-gauge, Type 316, and all buried boxes shall be precast polymer concrete UL tier 10 listed.

b. Stainless Steel

- 1) Junction and terminal boxes and cabinets not indicated on the Plans as Polymer Concrete shall be NEMA 4X, 14-gauge, Type 316 stainless steel enclosures with hinged, 14-gauge stainless steel doors supported by a continuous stainless steel hinge with removable pin. Seams shall be continuously welded and ground smooth. Each enclosure shall be provided with stainless steel fast operating door clamp assemblies and oil-resistant gasket to insure a watertight seal. Boxes and cabinets shall be Bulletin A51S and A4S with clamp assemblies A-L23SS as manufactured by Hoffman Engineering Company or equivalent as manufactured by Henessey or Weigmann or Engineer approved equal. Additional stainless steel box construction and sizes shall be as indicated on the Plans.
- 2) Surface mounted interior and exterior boxes shall be provided with external mounting lugs. No box shall be drilled for more conduits or cables than actually enter it. Exterior boxes shall be provided with 2 inch combination drain and breather fittings.
- 3) Terminal boxes shall be of sufficient size to provide ample room for the terminal blocks and interior wiring, and for the installation of conduit terminations. Interior mounting buttons with tapped holes shall be provided for mounting the terminal blocks. Terminal blocks shall be provided in each terminal box for the connection of all conductors including spare conductors entering the box plus at least ten percent spare terminals. All terminal blocks and

boards shall be mounted on suitable straps or structural steel brackets in such a manner as to permit routing the conductors behind the terminal blocks. Terminal blocks shall be one-piece blocks suitable for use in highly corrosive atmospheres and shall conform to the requirements hereinbefore specified.

- 4) Power terminal blocks for wires No. 8 AWG and larger shall be included in each terminal box as required for such conductors. Each terminal shall be a one-piece power distribution block of molded phenolic compound and shall conform to the requirements hereinbefore specified. A safety cover of insulating material shall be provided for each block.

AA. Hardware and Supports

1. Supports for conduits, cables, boxes, cabinets, disconnect switches, small limit switches, and other separately mounted items of electrical equipment shall be fabricated from structural steel not less than 3/8-inch thick. Clip angles and other supporting members which are fabricated from structural steel plates and shapes, and bolted to the structural members, shall be included with the structural steel. All other supporting members shall be included under the electrical work.
2. Structural steel brackets, boxes, and other equipment mounted on concrete surfaces shall be provided with a full neoprene gasket not less than 1/16-inch thick between the equipment and the surface of the concrete.
3. Expansion anchors for fastening equipment or brackets to concrete surfaces shall be wedge type anchor bolts, which shall be locked in place by an expansion wedge as the nut is tightened. All parts of the expansion anchors shall be of Type 304 stainless steel. Holes for the anchors shall be drilled to the size and depth recommended by the manufacturer using carbide tipped masonry drills.
4. Mounting bolts, nuts, washers, and other detail parts used for fastening boxes, disconnect switches, small limit switches, conduit clamps, cable supports, brackets, and other electrical equipment shall be of stainless steel conforming to the requirements of ASTM Designation A276, Type 316. Bolt heads and nuts shall be hexagonal and shall be provided with medium-series lock washers. Bolts smaller than 1/2-inch in diameter shall not be used, except as may be necessary to fit the mounting holes in small limit switches, boxes, and similar standard devices.
5. Usage of beam clamps for supporting conduits, boxes, or other equipment shall not be acceptable without prior approval of the Engineer.

6. Preformed stainless steel metal framing channels, will be acceptable for mounting or supporting electrical equipment, conduits, or boxes. Prior to installation the Contractor shall submit to the Engineer for review, his design, and shall not install the channels without approval.
7. Wiring and Cables
 - a. Except where otherwise noted, wiring in conduits shall be single-conductor.
 - b. All wiring and cables and their insulation and covering shall be of a nationally recognized brand, acceptable to the Engineer, and shall have marks always used on the particular brand for identifying it.
 - c. All wiring and cables shall conform to the requirements of NEMA Publication No. WC-70, and UL Standard 44. Before wire and cable orders are placed with any manufacturer, the Contractor shall submit for approval typical published test data for the type of insulation proposed, showing that it meets the requirements of NEMA Publication No. WC-70 for 0-600V rated circuit voltage phase-to-phase. The wire shall listed by Underwriters Laboratories for use in accordance with Article 310 of the National Electrical Code.
 - d. All materials used to fabricate insulated wiring and cables shall be certified to be from stock not more than 1 year old.
 - e. Single Conductors
 - 1) All single conductors shall be of stranded copper large enough to carry safely the maximum currents required without injurious heating or serious voltage drop. Conductors shall not be smaller than No. 12 AWG for power applications and control applications circuits, except as approved for control cabinet and desk wiring or for lighting fixtures.
 - 2) All conductors shall have Class B concentric stranding per UL Standard 44, except for conductors in flexible cables. A suitable separator over the conductor may be used at the option of the manufacturer.
 - 3) Each conductor shall be insulated with a cross linked polyethylene jacket complying with the physical and electrical requirements of UL Standard 44 for Type XHHW-2. The average thickness of insulation, for a given conductor size, shall be as specified in UL Standard 44 for Type XHHW-2. The minimum thickness at any point shall be not less than 90% of the specified average thickness.

The insulation shall be applied tightly to the conductor and shall be free-stripping.

- 4) Equipment ground conductors shall be bare, stranded, coated copper conforming to Class B stranding and the requirements of NEMA Publication No. WC-70, and UL Standard 44. Insulated ground conductor shall be sized in conformance with NEC and UL-listed as type XHHW-2 unless otherwise specified in the Contract Documents.
 - 5) Insulation for conductors installed inside the resistor enclosure shall be rated for an operating temperature of 150-degrees Celsius or higher.
 - 6) The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol and type designation. Color coding shall be as specified by NEC.
 - 7) Wire shall be tested in accordance with the requirements of UL Standard 44 for Type XHHW-2.
 - 8) The wire shall bear the Underwriters Laboratories label for Type XHHW-2.
- f. Flexible Multi-conductor Cables
- 1) The cables shall conform to ICEA S-95-658 / NEMA Pub. No. WC70, and as described under Section 7 of ICEA S-95-658/ NEMA WC70. Each cable shall be provided with a heavy duty neoprene jacket conforming to the requirements of NEMA Pub. No. WC70, Section 4.1 The size and quantity of conductors for the flexible cables shall be as shown on the Contract Documents.
 - 2) In each flexible cable, the insulated wires shall be cabled to a full circular section using non-hygroscopic fillers where necessary. Each layer of the conductors shall be covered with binder tape, and the cables' overall jacket shall be a thermoset rubber jacket. Insulation type of single conductors part of the flexible multi-conductor assembly shall be UL-listed Type RHW-2.
 - 3) The circuits across the navigable channel shall be carried in armored multi-conductor submarine cables, which is defined under Special Provision Section for Submarine Cables.

- g. Wire and Cable Testing
- 1) Single conductor wiring and flexible multi-conductor cables, including the insulating material, shall be tested to demonstrate that it meets specified requirements. The testing shall be done as stipulated in NEMA Publication No. WC70, Part 6, and detailed under Table 6-1. For single conductors of multiple-conductor cables, the Contractor shall conduct tests prior to assembly as multi-conductor cable, and after the overall jacket is applied in conformance to WC70, Sections 6.10.
 - 2) Conductors shall demonstrate flame retardancy in accordance with NEMA Publication No. WC70, Section 6.8.2 Vertical Flame Test (Type A). Wiring and cables shall not be shipped from the plant of the manufacturer until certified test reports on the cable properties have been approved by the Engineer.
 - 3) Submarine cable testing is defined under the item Submarine Cables.
- h. Wiring shall not be installed in any conduit before all joints are made up tightly and the conduits rigidly secured in place. The drawing of cables into conduits shall be done without injury to the wires or their insulation or covering. No lubricant of any kind shall be used for the pulling of wires, unless specifically authorized by the Engineer. Sufficient slack shall be left in all cables to permit proper connections in boxes, cabinets, and enclosures.
- i. Both ends of every single length of conductor shall be permanently and clearly tagged in accordance with the same numbers or designations appearing on the approved wiring diagrams.
- j. Conductors inside terminal boxes, the control console, and control panels shall be neatly formed into cables and laced with approved cable ties, with the individual conductors leaving the cable at their respective terminal points. These conductors shall be looped to allow not less than 3 inches of free conductor when disconnected. The formed cables shall be held securely away from the terminals and from contact with the enclosure by means of approved insulating supports.
- k. All outgoing wires, No. 8 AWG or smaller, in the control console and control panels and in terminal boxes shall be connected to terminal blocks of molded phenolic compound. Terminals shall be of screw type suitable for use with solderless, ring tongue, wire

connectors. Connectors, which extend beyond the ends of terminal block barriers, shall be furnished with an insulating sleeve covering the metal part of the connector. Taping of extended terminals will not be permitted.

- l. Each terminal of all terminal blocks shall be permanently marked to show the same number or designation as appears on the wire connected thereto.
- m. Splicing of wires will not be permitted, except for wiring to service lighting fixtures and receptacles. Wherever it becomes necessary to joint or branch conductors, terminal blocks shall be used, and wires shall be clearly tagged.
- n. The conductor sizes and number of wires shown on the Plans are the minimum permissible. The Contractor shall provide wiring and cables of sufficient size and number as may be required for the installation in accordance with the wiring diagrams on his approved working drawings. In each conduit and multi conductor cable containing ten or more conductors, at least one spare wire shall be provided for every ten conductors actually used.
- o. Multi conductor cables supported on the steel work shall be secured thereto by bent plate cable clamps spaced not more than 1.5m on centers. The cable clamps shall be fabricated from stainless steel plates bent to suit the cables' outside diameters. In general, the clamps shall be fastened to structural brackets bolted to the steel work. Where multi conductor cables enter the control console or any cabinets or boxes, they shall be provided with watertight cable terminators. Each cable terminator shall provide a watertight seal by compressing a tapered neoprene-sealing ring around the outer jacket of the cable.
- p. Conduit and Wiring Diagrams and Schedules
 - 1) The number and sizes of conduits, boxes, cabinets, wires and cables shown on the Contract Plans schematic layout diagrams and schedules are the minimum permissible for the power and control circuits of the systems shown on these Contract Plans. The Contractor shall provide conduits, conductors and cables of sufficient number and size, including spares, as may be required for the installation in accordance with the final wiring diagrams on the approved working drawings, and in compliance with NEC and all other applicable codes. The Contractor shall number and tag spare conductors as such, and spare conductors shall be shown on all shop and record drawings.

- 2) The schematic conduit diagrams on the Contract Plans and all associated tables, schedules and details do not purport to show all pull and terminal boxes, junction boxes, mounting hardware and supports associated with the complete and final installation of all bridge systems. The contractor shall furnish and install any additional boxes, supports and other hardware required to conform with these item's construction and installation specifications, and in compliance with all applicable codes.
 - 3) Flexible conduit sections, hardware and supports required for connections to motors and limit switches are not indicated on the Contract Plans.
 - 4) The schematic conduit diagrams and schedules on the Contract Plans show only the circuits and equipment directly concerned with the operation of the bridge and its auxiliaries, and do not purport to show all of the bridge conduit, wiring and other hardware and equipment that will be part of the complete, final installation. Circuits with conduit and wiring that may not be shown include service lighting, heating and AC, roadway lighting, bridge grounding system, generator or other backup auxiliary equipment, fire alarm system, intercom, telephone and other communications systems. And other related equipment,
 - 5) The schematic conduit diagrams do not purport to show physical layout and locations, of the equipment or of the associated conduit, wiring, boxes and other hardware, and should not be used for such purposes as substitutes for working or installation drawings. The Contractor is solely responsible to produce and submit for Engineer's approval such drawings as specified under these Special Provisions.
 - 6) Fittings, mounting supports, brackets, etc. are not shown on the conduit and wiring schematic diagrams.
- q. Control of Advance warning signs, Traffic Signals, Warning Gates and Gongs, and Barrier Gates
- 1) On each approach, existing traffic lights, warning gates, and gongs are to be replaced. Traffic gates are provided under the Specification's Special Provision Section "Traffic Gates". Barrier gates are provided under the Specification's Special Provision Section "Retractable Barrier Gates".

- 2) All equipment for controlling the operation of the traffic lights, warning gates and gongs, and barrier gates and all conduits, boxes, wiring, cables, and other equipment required to extend and connect the necessary circuits from the control house to the sign and signal equipment, warning gates, and gongs, and barrier gates on the approaches shall be done under this Specification's Special Provisions Section "Bridge Electrical and Control Equipment." The traffic signal operation shall be initiated by a two-position selector switch on the control desk. Red, amber and green pilot lights on control console indicate light status. The warning gates and barrier gates shall be controlled via pushbuttons on the control desk. Indicating lights on the control console indicate gate arm status.

r. Air Horns

- 1) Air horns for giving the necessary boat signals have been previously installed on the operator house.
- 2) The Contractor shall furnish and install all conduits, wiring, boxes, circuit breakers and any other equipment required to extend power to the air horns. Existing conduit and wiring shall be removed and new conduit and wires shall be installed.

s. Span Navigation Lights

- 1) The Contractor shall furnish and install all navigation light fixtures, conduits, wiring, boxes, circuit breakers and any other equipment required to extend power to the new navigation lights. Existing conduit and wiring shall be removed and new conduit and wires shall be installed. Interconnection to the span navigation lights shall be through a new cable.
- 2) The connections to the center span navigation lights shall be made with No. 10 AWG conductors in $\frac{3}{4}$ -inch PVC-coated rigid metal conduit. One conductor shall ground the span light housing.
- 3) The center span navigation lights shall be controlled by the fully open position generated from the main cam limit switch, so that the green lights shall show when both ends of the span are fully opened, and the red lights shall show when either end is not fully open. Loss of cam limit switch output will force span lights to red (fail-safe feature).

- 4) A selector switch shall be provided on the control desk for operating the Pier Dolphin lights as shown on the Plans

t. Provision for Roadway Lighting

- 1) On each bridge approaches, existing roadway lights shall be removed and replaced with new poles and luminaries as shown on plans.
- 2) Under the item of "Electrical Work" the Contractor shall furnish and install all conduits, wiring, boxes, circuit breakers and any other equipment required to extend power to the roadway lighting. Existing conduit and wiring shall be removed and new RGS conduits and new conductors shall be installed.

u. Painting

The requirements for painting machinery shall also apply to painting electrical equipment, unless otherwise specified.

- 1) Shop Painting:

Electrical equipment such as conduits, boxes, supports, and other devices which have a galvanized finish and equipment such as motors, brakes, control desk, and control panel frames and enclosures which normally are given a factory finish need not be shop painted. All other electrical equipment shall be given one shop coat.

- 2) Field Painting:

Electrical equipment which is normally given a factory painted finish suitable to the Engineer need not be field painted. All other electrical equipment, such as conduits, boxes, device enclosures, supporting clips and brackets, and other devices, shall be given two field coats of paint as specified under the requirements for painting machinery in Section 525. Before applying the two field coats, galvanized surfaces shall be cleaned free of all grease, oil, dirt, and foreign material and shall be etched with copper sulphate solution, after which the solution shall be applied. In lieu of etching and a coat of shop paint, the Contractor may use galvanizing primer as a first coat for galvanized surfaces. The final field coat on electrical equipment in the control house shall be of a color and type of paint to match the house interior.

v. Spare Parts

- 1) The Contractor shall furnish the following spare parts:
 - a) Two packages of six fuses of each kind and size installed.
 - b) A full set of contacts and contact fingers for each type of limit switch. For rotary limit switches, furnish a total of eight contact assemblies.
 - c) A set of contacts and contact fingers for each unit or fractional unit of five or less of each kind or size installed, including contactors and starters. Note: For units that do not incorporate replaceable contacts, furnish a complete unit with coil.
 - d) One coil for every five or less of each size relay/contactors, and motor starter installed.
 - e) One complete relay, timer, contactor, and starter for each unit or fractional unit of five or less of each kind and size installed.
 - f) Four heaters for overload relays of each size.
 - g) One complete tach generator set with over speed check limit switch assembly identical to the installed feedback assembly, one transmitter and one receiver type selsyn meters, and two separate encoder assemblies. All equipment shall be properly stored in the west machinery room.
 - h) (2) Spare control boards, pre-set for the direct replacement to the emergency SCR drives.
 - i) One (1) human interface module pre-set for direct reprogramming of the vector-controlled motor drives.
 - j) For the control console:
 - a) 6 indicating lamps for each type and voltage
 - b) 1 package of 6 meter lamps of each kind installed
 - c) 2 lens caps of each color

- d) 1 lens for each console unit
- 2) Any other spare-part listed in these specifications shall be included.
- 3) The Contractor shall arrange the spare parts in uniform size cartons of substantial construction, with typed and clearly varnished labels to indicate their contents, and store them where directed by the Engineer. Large spare parts shall be provided with moisture-proof wrapping. The Contractor shall also provide a directory of permanent type describing the parts. The directory shall state the name of each part, the manufacturer's number thereof, and the rating of the device for which the part is a spare. The spare parts shall also be marked to correspond with their respective item numbers as indicated on the elementary wiring diagram.

IV. METHOD OF MEASUREMENT.

A. The various electrical items will be measured as follows:

Pay Item	Pay Unit
Service Equipment	Lump Sum
Packaged Engine Generator Set	Lump Sum
Automatic Transfer Switch (ATS)	Lump Sum
Motor Control Center (MCC)	Lump Sum
Panelboards and Distribution Boards	Lump Sum
Lighting and Power Transformer	Lump Sum
Disconnect Switches	Lump Sum
Wiring	Lump Sum
Conduit	Lump Sum
Electric Utility Service Connection	Lump Sum
Electric Service Installation	Each

B. The Contractor will be reimbursed to the exact amount of money as billed by ComEd for its services under the pay item Electric Utility Service Connection. **For bidding purposes, this item shall be estimated as \$80,000.**

C. Work provided by the Contractor for electric service will be paid separately under the pay item Electric Service Installation. No extra compensation shall be paid to the Contractor for any incidental materials and labor required to fulfill the requirements as shown on plans and specified herein.

V. BASIS OF PAYMENT.

A. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
BRIDGE ELECTRICAL	Lump Sum

INTEGRATED BRIDGE CONTROL SYSTEM

I. DESCRIPTION

A. This work consists of furnishing, installing, and commissioning a new Bridge Control System complete in every detail for purposes specified.

B. Work shall included but not be limited to:

1. Furnish a complete and functional Integrated Bridge Control System, based on a Programmable Logic Controller (PLC). The system shall include a programming terminal, programming software, and complete bridge operations programming installed in the PLC processors.
2. Furnish and install enclosures and cabinets and control desks as shown in the Plans.
3. Furnish, integrate, coordinate, and install motor control centers and vector-controlled motor drives as specified in this specification.
4. Furnish and install, limit switches, and position transmitters. Adjust all devices as required for the proper operation or as required by the Engineer.
5. Furnish equipment, material, supplies, and special tools required for proper installation of the system.
6. Furnish and install all necessary equipment components and interconnections.
7. Provide the services of an individual who will coordinate the installation of all electrical equipment provided under this Contract and assure that all bridge operating

C. System Responsibility

1. All programmable controllers, panels, and field instrumentation specified in this section and for the Vector Controlled Motor Drives shall be furnished and installed by a single Bridge Control System Vendor. This System Vendor shall be responsible for assuring uniformity, compatibility, and integration of all control wiring interfaces for all of the equipment that is furnished under all sections of these Special Provisions and controlled by the Bridge Control System including, but not limited to:
 - a. Traffic Gates and Barriers
 - b. Traffic Signals
 - c. Center Locks
 - d. All Motor Controls
 - e. Navigation Lights and Signals
 - f. Emergency Generator and Automatic Transfer Switch
 - g. CCTV System
 - h. Fire Alarm System
2. All bridge operation control circuits shall be FAIL-SAFE.
3. The System Vendor shall name an individual who shall assume these responsibilities. This named individual and the title "System Integrator" shall be interchangeable where action is required of the System Vendor. This person shall be the sole contact between the Contractor, Movable Bridge Construction Specialist, and Engineer for purposes of coordination of the electrical control systems and resolving conflicts. This person shall be present and in charge of all control system related activities during the installation and startup of all critical elements and shall be present during all testing, calibration, and acceptance testing.

E. Submittals:

1. Shop drawing submittals shall be required for the integrated bridge control system consisting of all of the items in this section. General requirements for shop drawings are defined in Section 801. The drawings shall detail and accurately dimension all major components. Catalog sheets and vendor information shall be submitted for all electrical and electronic devices. Applications manuals shall be provided in the O&M Manual for all control devices. A control system PLC program ladder printout with full cross-reference shall be submitted to the Engineer for review and approval 8 weeks prior to the Factory Acceptance Test.

F. Quality Assurance

1. The complete control system shall be functionally tested, in the manufacturer's shop, to assure completeness and correct operation. The shop test shall be conducted prior to shipment. The shop test shall be witnessed by the Engineer. Following testing, the Engineer shall determine if the system is approved for shipping, or if corrections and further testing is needed.
2. Testing shall include simulation of all control functions. Inputs from field devices shall be simulated with toggle switches and outputs shall be simulated with indicator lights or relays.
3. The Contractor shall prepare and submit for approval a shop test procedure and schedule. Thirty (30) calendar days' advance notice shall be given to the Engineer so that the arrangements may be made. The shop test procedure shall be a step-by-step description of manual actions or simulations and the expected control response, output, or sequence of outputs. The shop test procedure will not be acceptable for the final acceptance test procedure.

G. References:

1. The fabrication materials and methods shall comply with the following codes and NFPA 79 Electrical Standard for Industrial Machinery and NFPA 70.

II. MATERIALS

A. Enclosures

1. Control Desks (E-CC-1, W-CC-1 & Bridge Power, Lighting & CCTV Control Desk)
2. Desk shall be a 12-gauge steel enclosure with doors in the front and a hinged sloping top. Enclosure shall measure approximately 35 to 43 inches high, 48 inches wide, and 24 inches deep. The enclosure top/operating panel shall be 10-gauge, 316 stainless steel with a brushed non-reflective finish. The supporting and enclosing structure shall be welded steel construction reinforced with angles and channels in the interior to form a rigid, freestanding console unit.
3. The interior framework shall provide support for instruments and permit control desk lifting without racking, distortion or deterioration of the structural integrity of the completed assembly. Removable lifting rings shall be furnished, designed to facilitate simple safe rigging and lifting of the enclosure during transportation and installation. Plugs shall be furnished and installed to unobtrusively fill the lifting rings holes when substituted for the lifting rings after installation is complete.

4. Construction shall conform to NEMA 12 construction. Sides and back shall have louvers with filters for ventilation. A thermostatically controlled fan shall be provided to turn on if interior temperature is higher than 90 ° F.
5. Doors shall be fully gasketed with neoprene gaskets securely glued in place. Doors shall be provided with continuous heavy-duty stainless steel hinges and a lockable 3-point latch.
6. Surface preparation and finish shall be as described for operating range. After punching for control devices, the top shall be brush finished.
7. A gooseneck light fixture and dimmer shall be provided on the top rear of desk E-CC-1. Lamp shall be 10 watt (max.) 120V.
8. Control desks will contain all pushbuttons, and indications, to operate the bridge. Layout of controls shall be as shown in the Plans. Component specifications follow in this section.
9. PLC I/O Cabinets (Drop 3 NE, Drop 5 SE, Drop 7 NW, Drop 8 SW)
10. The panel shall be a free-standing, 12-gauge steel enclosure with 2 doors. Construction shall conform to NEMA 12 standards. Enclosure seams shall be continuously welded and ground smooth. There shall be a rolled lip around the doors to prevent dirt and water from falling into the enclosure when doors are opened. Doors shall be fully gasketed with neoprene gaskets securely glued in place, and shall be provided with continuous heavy-duty stainless steel hinges and a lockable 3-point latch.
11. After fabrication of enclosure is complete, all sides and supports (internal and external) shall be cleaned and phosphatized before application of a high-quality rust-inhibiting primer. Finish coat shall be light gray ANSI No. 61 baked enamel or polyester powder.
12. Interior and back panel shall be high gloss white baked enamel.

B. Wiring

1. Interconnection wiring shall be provided between all electrical devices mounted in the panels and enclosures. If the devices are to be connected to external equipment, they shall be connected to terminal blocks.
2. Conductors insulation shall be UL-listed type XHHW-2, 600V. Minimum field installed control wire size within the control desk shall be No. 16 AWG. For all other panels No. 14 AWG minimum wire size shall be used unless otherwise noted on the Contract Plans. All control wire ampacity shall comply with the NEC. Wire insulation colors and identification shall conform to Section 16120.

3. All interior wiring shall be installed neatly and carefully, and shall be terminated on UL approved terminal blocks as per manufacturer's instructions.
4. Wiring to each control switch shall be individually bundled and shall be installed with a "drop loop" of sufficient length to allow its removal for maintenance without disconnecting the wiring. Plastic wire ways (open slot type) shall be used for routing all internal wiring in the panels.
5. Internal wiring in factory-wired electronic system cabinets may be installed according to the manufacturer's standard as to wire size, insulation, and method of termination on internal equipment.

C. Terminal Blocks

1. Terminal blocks shall be provided for conductors requiring connection to circuits external to the specified equipment, and where equipment parts replacement and maintenance will be facilitated. Terminal blocks shall be modular, rail-mounted, vibration-proof, tubular screw clamp type. Terminals shall be finger safe design.
2. Terminal blocks shall be grouped for easy accessibility, unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.
3. Each terminal block, device, circuit breaker, terminal, and both ends of each conductor shall be permanently labeled to coincide with the identification indicated on the Contract Plan wiring diagrams. Mounted electronic components shall be identified by nameplates as specified in Section 01010 beside the component. Terminal blocks for field connections shall be labeled with the wire numbers provided in the plan drawings.
4. Individual conductors shall be permanently identified. The marking shall be done on a sleeve not less than 1/2 inch long. Each sleeve shall be typewritten. The identification shall be size and shall be tightly installed on the wires.
5. Where the manufacturer's wire numbers conflict with the plan drawings at the field interface terminals, the Contractor shall install a second wire marker on the conductor in a location that will not obscure the original wire number.

D. Pushbuttons

1. Pushbuttons shall be 30.5 mm round type, non-illuminated.

2. Buttons shall be guarded by the housing to prevent accidental operation by objects being put on top of them. Push buttons shall be momentary operating. Each operator shall accommodate up to 4 stackable, 2 pole contact blocks. Contacts shall be rated for 10A continuous at 120 V ac in a 1 NO (Normally Open) and 1 NC (Normally Closed) cartridge, unless otherwise shown in the plan drawings.

3. Pushbuttons shall be provided with nameplates on control desk sub panel as listed below.

Tag Name	Color	Legend
PB-PLC-RESET	RED	PLC RESET

4. Pushbuttons shall be provided with engraved buttons as listed below.

Tag Name	Color	Legend
PB-STOP-SW	Black	STOP, SW LEAF
PB-STOP-SE	Black	STOP, SE LEAF
PB-STOP-NW	Black	STOP, NW LEAF
PB-STOP-NE	Black	STOP, NE LEAF
PB-AH	Black	AIR HORN

5. Illuminated pushbutton shall be provided with nameplate on control desk as listed below.

Tag Name	Color	Legend
PBL-UVSW	Red	SW FAULT, PUSH TO REST
PBL-UVSE	Red	SE FAULT, PUSH TO RESET
PBL-UVNW	Red	NW FAULT, PUSH TO RESET
PBL-UVNE	Red	NE FAULT, PUSH TIO RESET

E. Indicator Lights

1. Indicator lights shall be 30.5 mm round type. Indicator lights shall have colored plastic lenses with 120 V ac. daylight bright LED illuminators. Indicator lights shall be provided with dual input lamp test circuit.

2. Indicator lights shall be provided as follows:

Tag Name	Color	Indication
IL-PLC-N	GREEN	NORMAL PLC
IL-LCK-SW-S-G	Green	Driven
IL-LCK-SW-S-R	Red	Pulled
IL-LCK-SW-S-B	Blue	Hand crank
IL-LCK-SW-N-G	Green	Driven
IL-LCK-SW-N-R	Red	Pulled
IL-LCK-SW-N-B	Blue	Hand crank

IL-LCK-NW-S-G	Green	Driven
IL-LCK-SW-S-R	Red	Pulled
IL-LCK-NW-S-B	Blue	Hand crank
IL-LCK-NW-N-G	Green	Driven
IL-LCK-NW-N-R	Red	Pulled
IL-LCK-NW-N-B	Blue	Hand crank
IL-FO-SWS-G	Green	Fully Open
IL-NO-SWS-A	Amber	Nearly Open
IL-NC-SWS-A	Amber	Nearly Closed
IL-FC-SWS-R	Red	Fully Closed
IL-FS-SWS-W	White	Fully Seated
IL-FO-SES-G	Green	Fully Open
IL-NO-SES-A	Amber	Nearly Open
IL-NC-SES-A	Amber	Nearly Closed
IL-FC-SES-R	Red	Fully Closed
IL-FS-SES-W	White	Fully Seated
IL-FO-NWS-G	Green	Fully Open
IL-NO-NWS-A	Amber	Nearly Open
IL-NC-NWS-A	Amber	Nearly Closed
IL-FC-NWS-R	Red	Fully Closed
IL-FS-NWS-W	White	Fully Seated
IL-FO-NES-G	Green	Fully Open
IL-NO-NES-A	Amber	Nearly Open
IL-NC-NES-A	Amber	Nearly Closed
IL-FC-NES-R	Red	Fully Closed
IL-FS-NES-W	White	Fully Seated
IL-TRF-G	Green	Green
IL-TRF-R	Red	Red
IL-TG-SW-G	Green	Up
IL-TG-SW-R	Red	Down
IL-TG-SW-B	Blue	Hand crank
IL-TG-SE-G	Green	Up
IL-TG-SE-R	Red	Down
IL-TG-SE-B	Blue	Hand crank
IL-TG-NW-G	Green	Up
IL-TG-NW-R	Red	Down
IL-TG-NW-B	Blue	Hand crank
IL-TG-NE-G	Green	Up
IL-TG-NE-R	Red	Down
IL-TG-NE-B	Blue	Hand crank
IL-BG-SW-G	Green	Up
IL-BG-SW-R	Red	Down
IL-BG-SW-B	Blue	Hand crank
IL-BG-NE-G	Green	Up
IL-BG-NE-R	Red	Down
IL-BG-NE-B	Blue	Hand crank
IL-UTL-A	Amber	UTILITY
IL-GENR-B	Blue	Gen Run
IL-GENP-R	Red	Gen Pwr

3. The square basic unit shall have a 2.25-inch square display with back lighting to provide 4 separate indications. The unit shall be configurable for indicator lights, pushbutton, 2-3-4-position selector switch, selector switch with pushbutton, or selector switch with keyed operator.
4. Indicator lights shall be provided as follows:

Tag Name	Color	Indication
IL-MB-SWN-G	Green	Set
IL-MB-SWN-R	Red	Released
IL-MB-SWN-B	Blue	Manual Release
IL-MB-SWS-G	Green	Set
IL-MB-SWS-R	Red	Released
IL-MB-SWS-B	Blue	Manual Release
IL-MB-SEN-G	Green	Set
IL-MB-SEN-R	Red	Released
IL-MB-SEN-B	Blue	Manual Release
IL-MB-SES-G	Green	Set
IL-MB-SES-R	Red	Released
IL-MB-SES-B	Blue	Manual Release
IL-MOB-SWN-G	Green	Set
IL-MOB-SWN-R	Red	Released
IL-MOB-SWN-B	Blue	Manual Release
IL-MOB-SWS-G	Green	Set
IL-MOB-SWS-R	Red	Released
IL-MOB-SWS-B	Blue	Manual Release
IL-MOB-SEN-G	Green	Set
IL-MOB-SEN-R	Red	Released
IL-MOB-SEN-B	Blue	Manual Release
IL-MOB-SES-G	Green	Set
IL-MOB-SES-R	Red	Released
IL-MOB-SES-B	Blue	Manual Release
IL-MB-NWN-G	Green	Set
IL-MB-NWN-R	Red	Released
IL-MB-NWN-B	Blue	Manual Release
IL-MB-NWS-G	Green	Set
IL-MB-NWS-R	Red	Released
IL-MB-NWS-B	Blue	Manual Release
IL-MB-NEN-G	Green	Set
IL-MB-NEN-R	Red	Released
IL-MB-NEN-B	Blue	Manual Release
IL-MB-NES-G	Green	Set
IL-MB-NES-R	Red	Released
IL-MB-NES-B	Blue	Manual Release
IL-MOB-NWN-G	Green	Set
IL-MOB-NWN-R	Red	Released
IL-MOB-NWN-B	Blue	Manual Release

IL-MOB-NWS-G	Green	Set
IL-MOB-NWS-R	Red	Released
IL-MOB-NWS-B	Blue	Manual Release
IL-MOB-NEN-G	Green	Set
IL-MOB-NEN-R	Red	Released
IL-MOB-NEN-B	Blue	Manual Release
IL-MOB-NES-G	Green	Set
IL-MOB-NES-R	Red	Released
IL-MOB-NES-B	Blue	Manual Release
IL-DRV-SWN-W	White	SWN Running
IL-DRV-SWS-W	White	SWS Running
IL-DRV-SWN-R	Red	SWN Fault
IL-DRV-SWS-R	Red	SWS Fault
IL-DRV-SEN-W	White	SEN Running
IL-DRV-SES-W	White	SES Running
IL-DRV-SEN-R	Red	SEN Fault
IL-DRV-SES-R	Red	SES Fault
IL-DRV-NWN-W	White	NWN Running
IL-DRV-NWS-W	White	NWS Running
IL-DRV-NWN-R	Red	NWN Fault
IL-DRV-NWS-R	Red	NWS Fault
IL-DRV-NEN-W	White	NEN Running
IL-DRV-NES-W	White	NES Running
IL-DRV-NEN-R	Red	NEN Fault
IL-DRV-NES-R	Red	NES Fault
IL-PLC-CPU-G	Green	CPU 1 ON
IL-PLC-CPU-G	Green	CPU-2-ON
IL-PLC-CPU-R	Red	CPU 1 Fault
IL-PLC-CPU-R	Red	CPU 2 Fault
IL-COMED-G	Green	Feeder 1 On
IL-COMED-G	Green	Feeder 2 On
CSIL-NAV-G	Green	On
CSIL-NAV-R	Red	Off
CSIL-RWAY-W	White	AUTO
CSIL-RWAY-W	White	On
CSIL-RWAY-W	White	Off
IL-TIE-W-G	Green	Engaged
IL-TIE-W-R	Red	Disengaged
IL-TIE-W-B	Blue	Hand crank
IL-TIE-E-G	Green	Engaged
IL-TIE-E-R	Red	Disengaged
IL-TIE-E-B	Blue	Hand crank

F. Selector Switches

1. Two-position, maintained, 30 mm key operator. Key removable in the off position.

Tag Name	Legend
KS-DRFT-SW	DRIFT TEST SW LEAF _ OFF / DRIFT
KS-DRFT-SE	DRIFT TEST SE LEAF _ OFF / DRIFT
KS-DRFT-NW	DRIFT TEST NW LEAF _ OFF / DRIFT
KS-DRFT-NE	DRIFT TEST NE LEAF _ OFF / DRIFT
KS-C	CONTROL POWER _ OFF / ON

2. Two-position, spring return to left, 30 mm key operator. Key removable left position only.

Tag Name	Legend
BP-TRF-EB	EB TRAFFIC LIGHT BYPASS _ OFF / BYPASS
BP-TG-EB	EB TRAFFIC GATE BYPASS _ OFF / BYPASS
BP-BG-EB	EB BARRIER GATE BYPASS _ OFF / BYPASS
BP-LCK-EB	EB-SPAN LOCKS BYPASS _ OFF / BYPASS
BP-TRF-WB	EB TRAFFIC LIGHT BYPASS _ OFF / BYPASS
BP-TG-WB	EB TRAFFIC GATE BYPASS _ OFF / BYPASS
BP-BG-WB	EB BARRIER GATE BYPASS _ OFF / BYPASS
BP-LCK-WB	EB-SPAN LOCKS BYPASS _ OFF / BYPASS

3. Two-position, maintained, with standard operator handle.

Tag Name	Legend
CS-TRF	TRAFFIC LIGHTS Green . Red
CS-SPD	SPEED NORMAL /
REDUCED	
CS-SP-GRP	ALL LEAVES OPERATION _ GROUPED / NOT
GROUPED	
CSIL-NV	NAVIGATION LIGHTS OFF / ON

4. Three-position, maintained, with standard operator handle.

Tag Name	Legend
CSIL-RWAY	ROADWAY LIGHTS _ AUTO / OFF / ON

Three-position, momentary, spring return to center, with switchboard-type gloved-hand operator handle.

Tag Name	Legend
CS-LCK-SW	Southwest Locks (EB) _ Pull / / Drive
CS-SP-SW	Southwest Leaf _ Lower / / Raise
CS-SP-SE	Southeast Leaf _ Lower / / Raise
CS-LCK-NW	Northwest Locks (WB) _ Pull / / Drive
CS-SP-SW	Northwest Leaf _ Lower / / Raise

CS-SP-SE	Northeast Leaf	_	Lower /	/ Raise
CS-SP-WB	Westbound Leaves	_	Lower /	/ Raise
CS-SP-EB	Eastbound Leaves	_	Lower /	/ Raise
CS-TG-SW	ON-Coming SW TG	_	Lower /	/ Raise
CS-TG-NE	On-Coming NE TG	_	Lower /	/ Raise
CS-TG-SE	Off Going SE TG	_	Lower /	/ Raise
CS-TG-NW	Off Going NW TG	_	Lower /	/ Raise
CS-BG-NE	On-Coming NE BG	_	Lower /	/ Raise
CS-BG-SW	On-Coming SW BG	_	Lower /	/ Raise

- Two position, momentary, spring return to center from left, with switchboard-type gloved-hand operator handle.

Tag Name	Legend
CS-TG-GR	Traffic Gate Group Raise _ Raise /
CS-BG-GR	Barrier Gate Group Raise _ Raise /

G. Mushroom Push Button

- 30.5 mm oil-tight type operator with 64 mm red aluminum button head. Maintained position, contacts 10A, closed when head pulled out, open when head pushed in.

Tag Name	Legend
PB-STOP	EMERGENCY STOP

H. Foot Switch

- A foot switch shall be mounted on the front of the desk. It shall be provided with top and side shields made of 10-gauge metal (minimum) to prevent unintentional operation.
- The operation shall be momentary with spring return. Contacts cartridges shall be single pole double throw. Contacts shall be rated for 10A at 120 V ac. The number of contacts shall be as shown on the Plans, but not less than 2.

I. Light Fixture

- A goose-neck fixture with 10 watt (max.) lamp shall be fastened to the top rear of the console. Dimmer control shall be push on - push off type with rotary dimming control.

J. Watt meters

- Watt meters shall be 3½-digit, 7-segment, and 0.56-inch digital LED displays.

2. Input signal shall be 1-5 V dc process input.
3. Power supply shall be 115 V ac.
4. Input sensitivity shall be adjustable from 40 units/1v to 1000 units/1v. Linearity shall be +/-0.05 percent for +/- 1 digit. The Contractor shall coordinate calibration of meters with the transmitters provided with the span motor drive controllers.

K. Position Indicators

1. The position indicator shall be a 4-inch switchboard-type; taut band meters with 1-10 V dc movement. Input signal will be 1-10V d.c. as described below. A high-precision 250 ohm resistor shall be used to convert the current signal to voltage. Meter face shall be specially printed to show the degrees of rotation of the leaf

Tag Name	Legend	Approx. Calibration/Scale
SPOS-SWS	SOUTHWEST LEAF	5-10V / 90°- 0°
SPOS-SES	SOUTHEAST LEAF	1.5-5V / 180°- 90°
SPOS-NWS	NORTHWEST LEAF	5- 10V / 180°- 90°
SPOS-NES	NORTHEAST LEAF	1.5-5V / 180°- 90°

Note: Bridge span will only open to about 78°. Meters shall be zero and span calibrated as required for proper indication.

L. Position Transmitter

1. Position transmitter shall be potentiometer type and shall provide a 4-20 mA signal proportional to the rotation of the input shaft.
2. Transmitter shall be enclosed in an explosion-proof, weatherproof enclosure and shall be provided with a thermostatically controlled space heater. Input voltage shall be 24 V dc.
3. Enclosure shall be NEMA 4X, 316 SS 12 gauge minimum. Cover shall be removable with hinge type clamps. Cover shall be provided with neoprene gasket, glued securely in place. Shaft seal shall be watertight to 1000 PSI (high-pressure washer).

M. 24 V dc Regulated Power Supply

1. The power supply shall be rated for 120 V ac input and 24 V dc output, regulated linear with automatic fold-back short circuit protection. Amperage as required for the position transmitter. Rated at 40°C. Regulation line/load 0.005 percent, 1.5 mV. Ripple (RMS) 150 mV.

N. Uninterruptible Power Supply

1. Uninterruptible power supplies (UPS) shall be provided for system control power, 1 for the control desk CP-1 and 1 each for control panel CP-2 and CP-3. The UPS shall be an internal battery type, rated 3000 VA with 10-minute reserve power. Input voltage range shall be 120V / 80-144 V ac. Output voltage shall be 120V a.c., +/- 3 percent on utility or battery power. Output voltage shall be a sine wave with less than a 3-percent distortion. This system shall self-test on startup. Diagnostics and status shall be displayed on an LCD screen. An audible alarm shall be sounded for "on battery," low battery, overload, and UPS fault. A dry contact, relay output shall be provided. Transfer time shall be 0ms. UPS shall automatically transfer to bypass upon UPS failure. Transfer time to bypass shall be less than 4 ms. UPS shall have provisions for hardwire connection as well as locking receptacles.

O. Control Relays

1. Control relays shall be track-mounted industrial control relays, 2 to 8 poles as required, contacts shall be rated for 10 A continuous duty at 120 V ac. Operating voltage shall be 120 V ac. Relays shall have provisions for stacking additional poles or timing modules. Socket-mounted relays shall not be used.

P. Power Relays

1. Power relays or contactors shall be track-mounted, 2 to 9 poles as required, contacts shall be rated for 20 A continuous duty at 120 V ac. Operating voltage shall be 120 V ac. Socket-mounted relays shall not be used.

Q. Lever-Operated Limit Switches

1. Span Full Seated position sensing limit switches shall be lever-operated devices. Switch contacts shall be double pole double throw rated 10 A at 120 V ac. Both contacts shall be operated by the same armature.
2. Enclosure shall be watertight, stainless steel, with a side-mounted ½-inch conduit hub.
3. Limit switch mounting and trip brackets shall be fabricated from 1/8-inch mild steel. The brackets shall be cleaned, phosphatized, and painted with an epoxy coating that closely matches the color of the existing structure. The Contractor shall not weld to existing steel without prior approval of the Engineer.
4. Main rotary cam limit switch shall be installed and adjusted to trip as the span just touches the live load bearing.

5. The Contractor shall field fit limit switch mounting brackets and tripping devices. Suggested methods are shown in the Plans.
6. The machinery brakes and motor brakes shall have SET, RELEASED, and MANUALLY RELEASED lever-operated limit switches. The switch contacts shall be double pole double throw rated 10A at 120V a.c. Both contacts shall be operated by the same armature. The limit switches shall be furnished and mounted by the brake manufacturer on the brake assembly.
7. Each center lock lock bar shall have 2 lever-operated limit switches to monitor the LOCKED and UNLOCKED position. The switch contacts shall be double pole double throw rated 10 A at 120 V ac. Both contacts shall be operated by the same armature. The limit switch contacts shall be wired back to the PLC as shown in the Contract Plans. Mounting shall be as shown in the Contract Plans. Additional limit switches shall be furnished and installed by the lock manufacturer as required by Special Provisions Division 11, Section 18000, Part 2.3.

R. Rotary Limit Switches

1. Rotary limit switches shall have a weather-sealed NEMA 4X, 316 Stainless Steel housings design. Cover shall be designed to positively retain a gasket. A drain plug and breather shall allow condensation to evaporate or drain from housing. Construction shall be heavy-duty, durable and suitable for marine environment.
2. Rotary limit switches shall have 8 adjustable cam and switch sets. Cams shall be adjustable from 4° to 356°. Cams shall be individually adjustable and shall be firmly and immovably engaged to the shaft under operating conditions. Loosening of a single nut shall allow independent and individual adjustment of any individual cam or cam half. Adjustment of a cam shall not affect setting of other cams or cause movement of other cams. Re-tightening of the nut shall secure all cams to the shaft. Each cam shall consist of a pair of cam halves to permit independent setting of make and break points. Drive shall be direct drive by coupling to the trunnion shaft via adaptor. The coupling shall be as specified by the limit switch manufacturer. An integral gear increaser with a 1:4 ratio shall be provided for the input shaft. Contacts block shall be snap action, double pole double throw. Both contacts shall be operated by the same armature. Contact blocks shall be furnished and installed with plug-in sockets. Contacts shall be rated for a minimum of 10 A at 120 V ac. The number of circuits shall be as specified. Individual switches shall have clearly labeled screw-type wire connections and corrosion-resistant contacts. The enclosure shall contain the position transmitter as specified in Part 2.20.
3. The center lock actuator limit switches shall be lever actuated shall be wired back to the motor control center for motor control as shown in the Contract Plans.

S. Programmable Logic Controller

1. Furnish, install and program a programmable logic controller (PLC) system. System components shall include as a minimum the following:
 - a. Two (2) PLC processors. Both shall be installed in the main control cabinet (CP-1). Control power will be transferred from the A processor to the B processor upon a processor trouble signal from the watch dog timer. The A processor will be rest by pressing the "Reset Primary" push button on the control desk.
 - b. Two (2) input/output racks shall be installed in each main control panel and control desk. All required input and output modules.
 - c. Message display to be mounted in the control desk.
 - d. Programming terminal complete with programming software and all required cabling.
 - e. Spare parts as recommended by the PLC manufacturer for the system provided.
 - f. Programming of PLC control logic and PanelView displays.
2. Provide instruction manuals in the theory of operation and maintenance (O&M) information. Provide plastic-laminated schematics of all cards or units within the system.
3. The PLC and all components in the PLC system shall be manufactured by a single source and shall be the product of a company with a minimum of 10 years experience in the manufacture and service of this type of equipment.
4. Warranty: The PLC shall be warranted against defects in material and workmanship for a period of no less than 1 year from the date of final acceptance.
5. Compatibility: Wherever possible, all assemblies and sub-assemblies performing similar functions in separate controllers purchased under this specification shall be interchangeable without the need to reprogram.
6. Certification: The manufacturer shall be able to certify that the PLC, as submitted, can be normally used with any optional devices from the manufacturer, has been tested to successfully operate in the high electrical background noise environment of a large industrial plant.
7. Industry Standards: All components of the PLC system shall be of normally recognized industry standards and regularly sold to heavy industry installations. All components shall be housed in structurally

sound and finished metal cabinets or housings. All switches and other operator-controlled devices shall be of a size and durability for their intended use as is normally offered for industrial applications. All connecting cables shall be constructed so as to withstand, without damage, all normal use and handling. All components shall be "off-the-shelf" items from the PLC manufacturer. No custom components shall be used.

8. The PLC shall be Allen-Bradley (AB) SLC5 Series or equal approved by the Engineer. Processor shall have a capacity of 512 inputs and outputs, any mix, distributed in up to 4 remote input and output chassis. The processor shall be provided with a minimum of 20K words of CMOS memory and 20K words of EEPROM or flash-type non-volatile backup.
9. The following minimum features are required in the PLC:
 - a. Description: PLC manufactured to NEMA ICS 3, with component circuit boards manufactured to NEMA ICS 2.
 - b. The PLC system shall be of a modular design with a plug-in processing unit, input-output racks, and plug-in peripherals. All necessary cables shall be included.
 - c. Communications plug-ins shall be provided for redundant ControlNet communications (2 channels).
 - d. All major assemblies, sub-assemblies, circuit cards, and devices shall be permanently marked with the manufacturer's part or identification number.
 - e. All components of the PLC system, except programming terminals, shall be capable of continuous operation at temperatures of 10° to 60° C, and humidity levels of 25 to 95 percent non-condensing. The programming terminals shall be capable of continuous operation at temperatures of 10° to 40° C and humidity levels of 25 to 95 percent.
 - f. All programming and monitoring equipment shall be able to be connected or disconnected with the PLC in operation.
 - g. Input/output units shall be capable of being removed without disconnecting field wiring.
 - h. The PLC, including output devices, shall be shut down and an alarm sound in the event of:
 - 1) A disruption of program execution or scan.
 - 2) A loss of logic power.

- 3) A loss of communication between PLC and essential devices.
 - 4) A memory error.
10. Central Processing Unit
- a. Processor shall be programmable both off-line and on-line. A key lock switch shall be provided to protect the memory from unauthorized editing. Programming shall be accomplished via a laptop computer. The processor shall mount in and receive its power from an I/O chassis.
 - b. Processor shall be provided with LED indicating lights to indicate the following:
 - 1) Run/Fault Status
 - 2) Communication Active/Fault Status
 - 3) Forced Contacts Status
11. Programming Instruction Set
- a. Language Characteristics, Ladder Diagram. Structured text, sequential function charts, and embedded sub-routine programming shall not be used.
 - b. Logic Operations: AND, OR, XOR, NOT.
 - c. Register Operations: Store, Recall.
 - d. Math Operations: Addition, subtraction, multiplication, division.
 - e. Instruction Set: Relay coil; latch; bit follow; timer; counter; shift register; master control relay; skip; arithmetic; comparison; data move; block transfer; search matrix; AND; OR; XOR matrix; complement matrix; first-in stack; first-out fetch; last-out fetch; bit operate; n-bit serial register; I/O update immediate.
12. Input and Output: Each Input/output rack shall be complete with power supply and communication adapter. Chassis shall be sized as shown or for 2 spare slots if a different model is used. Module slots shall be keyed to prevent the insertion of improper modules. Slots shall be marked with type of module and address range. For modules that require DIP switch settings, slot marker shall also indicate the proper setting.
- a. Input modules shall be 16 point, 120 V ac.

- b. Output modules for indicating lights shall be 8 point, 120 V ac.
 - c. Relay outputs. Individual outputs shall be rated for 5 A. Outputs for inductive loads shall have MOV (metal oxide varistors) surge suppressors.
 - d. Analog input modules shall accept a 4-20 mA dc. signal.
 - e. Communications modules shall provide redundant (2-channel) ControlNet protocol communications to and from both primary and secondary CPUs.
13. Message Display: The message display shall be an Allen Bradley PanelView Plus 1000 with ControlNet communications or equal approved by the Engineer. Messages shall be programmed for display in response to input received from the PLC. Display programming shall feature historical recording for up to 1500 events. Message programming and historical data shall be stored in 64MB (minimum) of flash memory. Provisions shall be made for connecting a printer and downloading historical data.
- a. Memory firmware shall include a real time clock and programming menu.
 - b. Messages shall be programmable via laptop computer. The Contractor shall provide programming software. Display shall be provided with a housing, panel face for flush mounting on the control console, a sunshield, and glare guard.
14. Programming Terminal: A programming terminal shall be provided to the Contracting Agency. The terminal shall be a semi-rugged, severe-duty laptop, IBM compatible, drop and spill resistant, equivalent to a Panasonic Toughbook 52, with 15.4-inch flat display color monitor, and with MS Windows XP installed as the operating system. The programming terminal shall be provided with a minimum of 1GB of RAM memory and a minimum of 100 GB shock-mounted hard disk capacities. The optical disk drive shall be capable of reading and writing to Compact Disk (CD) and Digital Video Disk (DVD) format disks. The terminal shall be provided to the Contracting Agency with the following files stored on the hard disk along with original commercial software CDs and DVDs and licenses:
- a. PLC programming software
 - b. Final PLC program
 - c. Input/Output tag name and rung documentation
 - d. Ladder listing with annotations including cross-referencing

- e. PanelView programming software
 - f. PanelView alarm messages
 - g. Installation and programming manuals for the PLC processor, PanelView, modules, and all related components
 - h. The final PLC program shall also be provided to the Contracting Agency on DVD format disk.
 - i. Seven (7) copies of the PLC and PanelView programming manuals shall be provided.
15. Programming cables (2 each) shall be provided to connect the laptop to either PLC or the PanelView, to download program updates or upload data for analysis.
16. Electrical Interface: Capabilities shall be such as to provide for 25-percent expansion of input/outputs and instructions by the connection of additional units of equipment.
17. Supply Voltage: 90-130 V ac.

T. Spare Parts

1. The Contractor shall provide, in their original boxes or containers, the following spare parts:
- a. One (1) complete assembly of each of type of pushbutton used on the control desk.
 - b. One (1) complete pilot light assembly and 1 lens of each color used on the control desk.
 - c. One (1) of each type of control and time delay relay used in the control panels.
 - d. One (1) each of every type PLC card or module required.
 - e. One (1) of each type contactor.
 - f. One (1) of each type of power supply.
 - g. One (1) control power transformer.
 - h. Twelve (12) replacement incandescent or LED lamps for each type of pilot light used on the control desk.
 - i. Six (6) contact blocks for each type of selector switch.

III. CONSTRUCTION REQUIREMENTS

A. Bridge Operating Requirements

1. The Contractor shall develop the PLC program and Message Display text using the Description of Operation provided in this article and the Plan drawings. Allowing for specific requirements of the PLC as supplied, the program ladder logic shall follow as closely as possible, the Plan drawings. The Contractor shall convey all software licenses and programming to the Contracting Agency free and clear of all encumbrances.
2. Normal Operation:
 - a. Insert key and turn control power ON. (Key is captive in the ON position) Observe green indicator lights and meters turn on.
 - b. Push HORN button to signal marine traffic.
 - c. Turn traffic lights switch to "RED" button. Traffic signals switch to yellow, advance warning lights flash. After 5 seconds, traffic lights turn red, gate arm lights flash and gongs start and west advanced warning sign lights begin to flash.
 - d. Observe that traffic has stopped. Turn and hold the Southwest (SW) and Northeast (NE) oncoming gate "LOWER" switches. Observe that when gates start to lower, both the red and green indicator lights are illuminated. The green light turns off when last gate is fully down and the red light glows steady. This indicates that the off going gates may be lowered. Releasing the switch at any time will halt gate movement.
 - e. Observe that traffic and pedestrians have cleared the bridge. Turn and hold the Southeast (SE) and Northwest (NW) off going gates "LOWER" switches. The off going gates are lowered. Observe that both the red and green indicator lights are illuminated when the gates begin to move. Releasing the switch at any time will halt gate movement. The green lights turns off when they are fully down and the red lights glow steady. This indicates that the barrier gates may be lowered.
 - f. Observe that traffic has cleared the bridge. Turn and hold the Southwest (SW) and Northeast (NE) barrier "LOWER" switches. The barrier gates are lowered. Observe that both the red and green indicator lights are illuminated when the gates begin to move. Releasing the switch at any time will halt gate movement. The green lights turns off when they are fully down and the red lights glow steady. This indicates that the center lock may be unlocked.

- g. Turn and hold the "SOUTHWEST LOCKS (EB) and the "NORTHWEST LOCKS (WB)" switch to" PULL". Observe that both the red and green indicator lights are illuminated. The green turns off and the red light is steady when the center lock is pulled. When the green light turns off the leaf motor drives are enabled.
- h. Push and hold the "EASTBOUND LEAVES" switch and "WESTBOUND LEAVES" switch to "RAISE". Step on the "dead man", foot switch and release the "EASTBOUND LEAVES" switch and "WESTBOUND LEAVES" switch. The PLC releases the machinery brakes and allows the Raise command to the motor controller. The motor drives releases the motor brakes, energizes the motors and the leaves begin to rise. Stepping off the "dead man" foot switch stops the Raise operation and sets the machinery brakes.
- i. Observe the brake release indicators, the meters and the position indicator lights are on. Upon rising, when each leaf passes the nearly closed position, the nearly closed lights turn off. When the leaf passes the nearly open position, the nearly open light turns on and the leaf drive decelerates the leaf to creep speed.
- j. Leaf operation is controlled by the motor drives. As each leaf reaches its nearly open position its drive automatically slows the leaf and then stops it at the full open position. The nearly open light turns off, the full open light turns on, and the drive stops the motor and sets motor brakes.
- k. Stepping off the deadman foot switch sets the machinery brakes.
- l. When both leaves are fully open the navigation lights on the leaf tips change from red to green.
- m. The leaves may be stopped at any position by releasing the "dead-man" foot switch. Movement may proceed from the stop in either direction by turning the appropriate switch and stepping on the deadman foot switch.
- n. Begin closing sequence by observing that waterway is clear. Push horn button to signal marine traffic.
- o. Turn and hold the "EASTBOUND LEAVES" switch and "WESTBOUND LEAVES" switch to "LOWER". Step on the "dead man" foot switch and release the switches. The PLC releases the machinery brakes and allows the LOWER command to the motor drives. The motor drives releases the motor brakes, energizes the motors, and the leaf begins to lower.

- p. The indications are the same as when raising the leaves except in reverse. When the first leaf is no longer fully open, the navigation lights on the leaf tips change from green to red.
- q. Leaf operation is controlled by the motor drives. As each leaf reaches its nearly closed position its drive automatically slows the leaf and stops at the full seated position. The leaf drive holds reduced torque on the leaf and sets the motor brakes. When the brakes are set the drive de-energizes the motor.
- r. Step off the dead man foot switch to set machinery brakes. Center locks are enabled.
- s. Turn and release "SOUTHWEST LOCKS (EB)" switch and the "NORTHWEST LOCKS (WB)" switch to "DRIVE". Observe lights when red turns off.
- t. Turn and release the "BARRIER GROUP RAISE" switch to "RAISE". When each barrier gate is raised the traffic gates are enabled.
- u. Turn and release the "TRAFFIC GATE GROUP RAISE" switch to "RAISE". Observe gate operation. When all gates are raised, the traffic lights may be switched to green.
- v. Turn "TRAFFIC LIGHTS" switch to "GREEN". Traffic signals switch to green, the gate arm lights turn off, the gongs stop and the advanced warning sign lights turn off.
- w. Turn control power off and remove key.

B. Interlock Bypasses

- 1. The function of the bypass switches is to bypass the field limit switches, so that a failed limit switch will not prevent the operation of the bridge. The bypasses operate as follows:
 - a. Allows off-going gates to be lowered if an oncoming gate full down limit switch has failed.
 - b. Allows barrier gates to be lowered if an off-going gate full down limit switch has failed
 - c. Allows locks to be pulled if a barrier gate full down limit switch has failed.
 - d. Allows off-going gates to be raised if a barrier gate full up limit switch has failed

- e. Allows oncoming gates to be raised if an off-going gate full up limit switch has failed.
- f. Allows traffic lights to be reset to green if an oncoming gate full up limit switch has failed.
- g. Allows spans to be raised if a center lock "pulled" limit switch has failed.
- h. Allows gates to be raised if a center lock "driven" limit switch has failed.
- i. Allows center locks to be locked if a full seated limit switch fails.

C. Drive Group / UnGroup

- 1. The "ALL LEAVES OPERATION" switch in the "GROUP ON" allows operation by the "WESTBOUND LEAVES" and the "EASTBOUND LEAVES" switches. The "UNGROUPED" position inhibits the "WESTBOUND LEAVES" and the "EASTBOUND LEAVES" switches. Leaf operation is by the individual "SE LEAF", "SW LEAF", "NE LEAF", "NW LEAF" switches.

D. Emergency Stop

- 1. The EMERGENCY STOP button is for panic use only. It removes all control power from the system including emergency bypass operation. All motors stop and brakes set.
- 2. The button is a maintained switch and operates a maintained contact – push to open the circuit, pull to restore. If the EMERGENCY STOP is pushed, all "latched" control circuits are dropped out.
- 3. Operation must be manually restarted after Emergency Stop button is pulled out.

E. Alarms

- 1. The PLC shall transmit the alarm message number to the PanelView HMI (Human Machine interface). The HMI alarm tone shall sound with each message until the acknowledge button has been pushed. The HMI shall be programmed to display and record the date and time of the message and the date and time when the alarm was acknowledged.
- 2. The Contractor shall be required to add at no additional cost, during the shop testing, installation or final testing, up to 20 percent additional alarms.

- a. Alarm (A): PLC FAULT
Condition (C): Internal watchdog timer times out or external watchdog timer times out.
- b. A: PLC RACK IN CONTROL DESK E-CC-1 FAULT
C: Rack fault bit is detected.
- c. A: PLC RACK IN CONTROL DESK W-CC-1 FAULT
C: Rack fault bit is detected.
- d. A: PLC RACK IN DROP 3 I/O CABINET FAULT
C: Rack fault bit is detected.
- e. A: PLC RACK IN DROP 5 I/O CABINET FAULT
C: Rack fault bit is detected.
- f. A: PLC RACK IN DROP 7 I/O CABINET FAULT
C: Rack fault bit is detected.
- g. A: PLC RACK IN DROP 8 I/O CABINET FAULT
C: Rack fault bit is detected.
- h. A: TRAFFIC GATE TG-SW-N NOT READY
A: TRAFFIC GATE TG-SW-S NOT READY
A: TRAFFIC GATE TG-SE-N NOT READY
A: TRAFFIC GATE TG-SE-S NOT READY
A: TRAFFIC GATE TG-NW-N NOT READY
A: TRAFFIC GATE TG-NW-S NOT READY
A: TRAFFIC GATE TG-NE-N NOT READY
A: TRAFFIC GATE TG-NE-S NOT READY
C: The traffic gate control input is off.
- i. A: TRAFFIC GATE TG-SW-N STARTER TROUBLE
A: TRAFFIC GATE TG-SW-S STARTER TROUBLE
A: TRAFFIC GATE TG-SE-N STARTER TROUBLE
A: TRAFFIC GATE TG-SE-S STARTER TROUBLE
A: TRAFFIC GATE TG-SW-N STARTER TROUBLE
A: TRAFFIC GATE TG-SW-S STARTER TROUBLE
A: TRAFFIC GATE TG-SE-N STARTER TROUBLE
A: TRAFFIC GATE TG-SE-S STARTER TROUBLE
C: Lower gate output is turned on, the auxiliary contact input is turned on, and gate full up limit switch input remains turned on for more than 2 seconds, or the lower gate output is turned on, the auxiliary contact input is turned on and gate down limit switch input remains turned off after 10 seconds or raise gate output is turned on, the auxiliary contact input is turned on, and gate down limit switch input remains turned on for more than 2 seconds or raise gate output is turned on, the auxiliary contact input is turned on, and gate full up limit switch input

remains turned off after 10 seconds, or the Lower gate output is turned on and the starter auxiliary contact input remains turned off for more than 2 seconds or the raise gate output is turned on and the starter auxiliary contact input remains turned off for more than 2 seconds.

- j. A: TRAFFIC GATE TG-SW-N RAISE TROUBLE
A: TRAFFIC GATE TG-SW-S RAISE TROUBLE
A: TRAFFIC GATE TG-SE-N RAISE TROUBLE
A: TRAFFIC GATE TG-SE-S RAISE TROUBLE
A: TRAFFIC GATE TG-NW-N RAISE TROUBLE
A: TRAFFIC GATE TG-NW-S RAISE TROUBLE
A: TRAFFIC GATE TG-NE-N RAISE TROUBLE
A: TRAFFIC GATE TG-NE-S RAISE TROUBLE
C: The gate starter auxiliary contact input is turned on, the gate full up limit switch input is turned off and the gate motion or travel timer times out.

- k. A: TRAFFIC GATE TG-SW-N LOWER TROUBLE
A: TRAFFIC GATE TG-SW-S LOWER TROUBLE
A: TRAFFIC GATE TG-SE-N LOWER TROUBLE
A: TRAFFIC GATE TG-SE-S LOWER TROUBLE
A: TRAFFIC GATE TG-NW-N LOWER TROUBLE
A: TRAFFIC GATE TG-NW-S LOWER TROUBLE
A: TRAFFIC GATE TG-NE-N LOWER TROUBLE
A: TRAFFIC GATE TG-NE-S LOWER TROUBLE
C: The gate starter auxiliary contact input is turned on, the gate full down limit switch input is turned off and the gate motion or travel timer times out.

- l. A: TRAFFIC GATE TG-SW-N RAISE BYPASS ON
A: TRAFFIC GATE TG-SW-S RAISE BYPASS ON
A: TRAFFIC GATE TG-SE-N RAISE BYPASS ON
A: TRAFFIC GATE TG-SE-S RAISE BYPASS ON
A: TRAFFIC GATE TG-NW-N RAISE BYPASS ON
A: TRAFFIC GATE TG-NW-S RAISE BYPASS ON
A: TRAFFIC GATE TG-NE-N RAISE BYPASS ON
A: TRAFFIC GATE TG-NE-S RAISE BYPASS ON
C: The respective gate full down input is off the related traffic gate full down input is off, the trouble acknowledge is on, and the master bypass input is on.

- m. A: TRAFFIC GATE TG-SW-N LOWER BYPASS ON
A: TRAFFIC GATE TG-SW-S LOWER BYPASS ON
A: TRAFFIC GATE TG-SE-N LOWER BYPASS ON
A: TRAFFIC GATE TG-SE-S LOWER BYPASS ON
A: TRAFFIC GATE TG-NW-N LOWER BYPASS ON
A: TRAFFIC GATE TG-NW-S LOWER BYPASS ON
A: TRAFFIC GATE TG-NE-N LOWER BYPASS ON
A: TRAFFIC GATE TG-NE-S LOWER BYPASS ON

C: The respective gate full up input is off the related traffic gate full up input is off, the trouble acknowledge is on, and the "EB" or "WB" "TRAFFIC GATE BYPASS" input is on.

- n. A: TRAFFIC GATE TG-SW-N RAISE TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-SW-S LOWER TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-SE-N RAISE TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-SE-S LOWER TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-NW-N RAISE TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-NW-S LOWER TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-NE-N RAISE TROUBLE
 ACKNOWLEDGE
 A: TRAFFIC GATE TG-NE-S LOWER TROUBLE
 ACKNOWLEDGE
 C: Alarm acknowledge input is turned on.
- o. A: BARRIER GATE BG-SW-N NOT READY
 A: BARRIER GATE BG-SW-S NOT READY
 A: BARRIER GATE BG-NE-N NOT READY
 A: BARRIER GATE BG-NE-S NOT READY
 C: The Barrier Gate control input is off.
- p. A: BARRIER GATE BG-SW-N DRIVE TROUBLE
 A: BARRIER GATE BG-SW-S DRIVE TROUBLE
 A: BARRIER GATE BG-NE-N DRIVE TROUBLE
 A: BARRIER GATE BG-NE-S DRIVE TROUBLE
 C: The Barrier Gate Drive Control input is on and the Drive Trouble input is on.
- q. A: CENTER LOCK CL SW-N NOT READY
 A: CENTER LOCK CL-SW-S NOT READY
 A: CENTER LOCK CL NW-N NOT READY
 A: CENTER LOCK CL-NW-S NOT READY
 C: The Center Lock control input is off.
- r. A: CENTER LOCK CL-SW-N STARTER TROUBLE
 A: CENTER LOCK CL-SW-S STARTER TROUBLE
 A: CENTER LOCK CL-NW-N STARTER TROUBLE
 A: CENTER LOCK CL-NW-S STARTER TROUBLE
 C: Center Locks drive output is turned on, the auxiliary contact input is turned on, and the Center Lock pulled limit switch input remains turned on for more than 2 seconds, or the Center

Locks pull output is turned on, the auxiliary contact input is turned on and Center Locks driven limit switch input remains turned off after 2 seconds or Center Locks drive output is turned on, the auxiliary contact input is turned on, and pulled limit switch input remains turned off for more than 15 seconds or Center Locks pulled output is turned on, the auxiliary contact input is turned on, and the drive limit switch input remains turned off after 15 seconds

- s. A: CENTER LOCK CL-SW-N PULLED TROUBLE
A: CENTER LOCK CL-SW-S PULLED TROUBLE
A: CENTER LOCK CL-NW-N PULLED TROUBLE
A: CENTER LOCK CL-NW-S PULLED TROUBLE
C: The Center Lock pull starter auxiliary contact input is turned on, the Center Locks pulled limit switch input is turned off and the Center Locks motion or travel timer times out.

- t. A: CENTER LOCK CL-SW-N DRIVE TROUBLE
A: CENTER LOCK CL-SW-S DRIVE TROUBLE
A: CENTER LOCK CL-NW-N DRIVE TROUBLE
A: CENTER LOCK CL-NW-S DRIVE TROUBLE
C: The Center Lock drive starter auxiliary contact input is turned on, the Center Locks drive limit switch input is turned off and the Center Locks motion or travel timer times out.

- ON u. A: CENTER LOCK CL-SW-N EB SPAN LOCK DRIVE BYPASS
A: CENTER LOCK CL-SW-S EB SPAN LOCK DRIVE BYPASS
ON
A: CENTER LOCK CL-NW-N WB SPAN LOCK DRIVE BYPASS
ON
A: CENTER LOCK CL-NW-S WB SPAN LOCK DRIVE BYPASS
ON
C: The respective Center Lock drive input is on, the Center Locks pulled limit switch input is off, the trouble acknowledge is on, and the "EB" or "WB" "SPAN LOCK BYPASS" input is on.

- ON v. A: CENTER LOCK CL-SW-N EB SPAN LOCK PULL BYPASS
A: CENTER LOCK CL-SW-S EB SPAN LOCK PULL BYPASS
ON
A: CENTER LOCK CL-NW-N EB SPAN LOCK PULL BYPASS
ON
A: CENTER LOCK CL-NW-S EB SPAN LOCK PULL BYPASS
ON
C: The respective Center Lock pull input is on, the Center Locks drive limit switch input is off, the trouble acknowledge is on, and the "EB" or "WB" "SPAN LOCK BYPASS" input is on.

- w. A: CENTER LOCK CL-SW-N PULL TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-SW-S PULL TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-NW-N PULL TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-NW-S PULL TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-SW-N DRIVE TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-SW-S DRIVE TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-SW-N DRIVE TROUBLE ACKNOWLEDGE
A: CENTER LOCK CL-SW-S DRIVE TROUBLE ACKNOWLEDGE
C: Alarm acknowledge input is turned on.

- x. A: MACHINE BRAKE MB-SW-N NOT READY
A: MACHINE BRAKE MB-SW-S NOT READY
A: MACHINE BRAKE MB-SE-N NOT READY
A: MACHINE BRAKE MB-SE-S NOT READY
A: MACHINE BRAKE MB-NW-N NOT READY
A: MACHINE BRAKE MB-NW-S NOT READY
A: MACHINE BRAKE MB-NE-N NOT READY
A: MACHINE BRAKE MB-NE-S NOT READY
A: MOTOR BRAKE MOB-SW-N NOT READY
A: MOTOR BRAKE MOB-SW-S NOT READY
A: MOTOR BRAKE MOB-SE-N NOT READY
A: MOTOR BRAKE MOB-SE-S NOT READY
A: MOTOR BRAKE MOB-NW-N NOT READY
A: MOTOR BRAKE MOB-NW-S NOT READY
A: MOTOR BRAKE MOB-NE-N NOT READY
A: MOTOR BRAKE MOB-NE-S NOT READY
C: The machine or motor brake control input is off.

- y. A: MACHINE BRAKE MB-SW-N MANUALLY RELEASED
A: MACHINE BRAKE MB-SW-S MANUALLY RELEASED
A: MACHINE BRAKE MB-SE-N MANUALLY RELEASED
A: MACHINE BRAKE MB-SE-S MANUALLY RELEASED
A: MACHINE BRAKE MB-NW-N MANUALLY RELEASED
A: MACHINE BRAKE MB-NW-S MANUALLY RELEASED
A: MACHINE BRAKE MB-NE-N MANUALLY RELEASED
A: MACHINE BRAKE MB-NE-S MANUALLY RELEASED
A: MOTOR BRAKE MOB-SW-N MANUALLY RELEASED
A: MOTOR BRAKE MOB-SW-S MANUALLY RELEASED
A: MOTOR BRAKE MOB-SE-N MANUALLY RELEASED
A: MOTOR BRAKE MOB-SE-S MANUALLY RELEASED
A: MOTOR BRAKE MOB-SW-N MANUALLY RELEASED
A: MOTOR BRAKE MOB-SW-S MANUALLY RELEASED
A: MOTOR BRAKE MOB-SE-N MANUALLY RELEASED
A: MOTOR BRAKE MOB-SE-S MANUALLY RELEASED

- C: The brake manually released limit switch input is off.

- z.
 - A: MACHINE BRAKE MB-SW-N TROUBLE
 - A: MACHINE BRAKE MB-SW-S TROUBLE
 - A: MACHINE BRAKE MB-SE-N TROUBLE
 - A: MACHINE BRAKE MB-SE-S TROUBLE
 - A: MACHINE BRAKE MB-NW-N TROUBLE
 - A: MACHINE BRAKE MB-NW-S TROUBLE
 - A: MACHINE BRAKE MB-NE-N TROUBLE
 - A: MACHINE BRAKE MB-NE-S TROUBLE
 - C: The machine brake release output is turned on, the release auxiliary contact input is turned on, and the machine brake limit switch input remains turned on for more than 2 seconds, or the machine brake set output is turned on, the set auxiliary contact input is turned on and machine brake release limit switch input remains turned off after 2 seconds or machine brake release output is turned on, the release auxiliary contact input is turned on, and machine brake release limit switch input remains turned off for more than 15 seconds or machine brake set output is turned on, the auxiliary contact input is turned on, and the machine brake set switch input remains turned off after 15 seconds.

- aa.
 - A: MOTOR BRAKE MOB-SW-N TROUBLE
 - A: MOTOR BRAKE MOB-SW-S TROUBLE
 - A: MOTOR BRAKE MOB-SE-N TROUBLE
 - A: MOTOR BRAKE MOB-SE-S TROUBLE
 - A: MOTOR BRAKE MOB-NW-N TROUBLE
 - A: MOTOR BRAKE MOB-NW-S TROUBLE
 - A: MOTOR BRAKE MOB-NE-N TROUBLE
 - A: MOTOR BRAKE MOB-NE-S TROUBLE
 - C: The motor brake release output is turned on, the release auxiliary contact input is turned on, and the motor brake limit switch input remains turned on for more than 2 seconds, or the motor set output is turned on, the set auxiliary contact input is turned on and motor brake release limit switch input remains turned off after 2 seconds or motor brake release output is turned on, the release auxiliary contact input is turned on, and motor brake release limit switch input remains turned off for more than 15 seconds or motor brake set output is turned on, the auxiliary contact input is turned on, and the motor brake set switch input remains turned off after 15 seconds.

- bb.
 - A: MACHINE BRAKE MB-SW-N DID NOT SET
 - A: MACHINE BRAKE MB-SW-S DID NOT SET
 - A: MACHINE BRAKE MB-SE-N DID NOT SET
 - A: MACHINE BRAKE MB-SE-S DID NOT SET
 - C: The brake set limit switch input is off and the brake thruster output is off.

- cc. A: MOTOR BRAKE MOB-SW-N DID NOT SET
A: MOTOR BRAKE MOB-SW-S DID NOT SET
A: MOTOR BRAKE MOB-SE-N DID NOT SET
A: MOTOR BRAKE MOB-SE-S DID NOT SET
A: MOTOR BRAKE MOB-NW-N DID NOT SET
A: MOTOR BRAKE MOB-NW-S DID NOT SET
A: MOTOR BRAKE MOB-NE-N DID NOT SET
A: MOTOR BRAKE MOB-NE-S DID NOT SET
C: The drive running input is off and the motor brake set limit switch input is off.

- dd. A: MACHINE BRAKE MB-SW-N DID NOT RELEASE
A: MACHINE BRAKE MB-SW-S DID NOT RELEASE
A: MACHINE BRAKE MB-SE-N DID NOT RELEASE
A: MACHINE BRAKE MB-SE-S DID NOT RELEASE
A: MACHINE BRAKE MB-NW-N DID NOT RELEASE
A: MACHINE BRAKE MB-NW-S DID NOT RELEASE
A: MACHINE BRAKE MB-NE-N DID NOT RELEASE
A: MACHINE BRAKE MB-NE-S DID NOT RELEASE
C: The brake released limit switch input is off and the brake thruster output is on.

- ee. A: MOTOR BRAKE MOB-SW-N DID NOT RELEASE
A: MOTOR BRAKE MOB-SW-S DID NOT RELEASE
A: MOTOR BRAKE MOB-SE-N DID NOT RELEASE
A: MOTOR BRAKE MOB-SE-S DID NOT RELEASE
A: MOTOR BRAKE MOB-NW-N DID NOT RELEASE
A: MOTOR BRAKE MOB-NW-S DID NOT RELEASE
A: MOTOR BRAKE MOB-NE-N DID NOT RELEASE
A: MOTOR BRAKE MOB-NE-S DID NOT RELEASE
C: The brake released limit switch input is off and the Drive Running input is on.

- ff. A: DRIVE M-SW-N NOT READY
A: DRIVE M-SW-S NOT READY
A: DRIVE M-SE-N NOT READY
A: DRIVE M-SE-S NOT READY
A: DRIVE M-NW-N NOT READY
A: DRIVE M-NW-S NOT READY
A: DRIVE M-NE-N NOT READY
A: DRIVE M-NE-S NOT READY
C: Motor drive control input is off.

- gg. A: DRIVE M-SW-N TROUBLE
A: DRIVE M-SW-STROUBLE
A: DRIVE M-SE-N TROUBLE
A: DRIVE M-SE-S TROUBLE
A: DRIVE M-NW-N TROUBLE

- A: DRIVE M-NW-STROUBLE
 - A: DRIVE M-NE-N TROUBLE
 - A: DRIVE M-NE-S TROUBLE
 - C: The Drive Control input is on and the Drive Trouble input is on.
- hh.
- A: SOUTHWEST LEAF SEATING TROUBLE
 - A: SOUTHEAST LEAF SEATING TROUBLE
 - A: NORTHWEST LEAF SEATING TROUBLE
 - A: NORTHEAST LEAF SEATING TROUBLE
 - C: The leaf full SEATED limit switch input is off, the bridge open command input is off, the control power input is on, and the leaf seating timer is greater than 5 to 15 seconds.
- ii.
- A: SOUTHWEST LEAF SEATING TROUBLE ACKNOWLEDGE
 - A: SOUTHEAST LEAF SEATING TROUBLE ACKNOWLEDGE
 - A: NORTHWEST LEAF SEATING TROUBLE ACKNOWLEDGE
 - A: NORTHEAST LEAF SEATING TROUBLE ACKNOWLEDGE
 - C: The leaf seating trouble input is on, the control power input is on, the leaf seating bypass input is off, and the alarm acknowledge input is on.
- jj.
- A: WEST LEAF SEATING BYPASS ON
 - A: EAST LEAF SEATING BYPASS ON
 - C: The center locks locked input is off, the open bridge command input is off, the control power input is on, the seating trouble acknowledge input is on, and the master bypass input is on.
- kk.
- A: SOUTHWEST NEARLY CLOSED LIMIT SWITCH TROUBLE
 - A: SOUTHEAST NEARLY CLOSED LIMIT SWITCH TROUBLE
 - A: NORTHWEST NEARLY CLOSED LIMIT SWITCH TROUBLE
 - A: NORTHEAST NEARLY CLOSED LIMIT SWITCH TROUBLE
 - C: The leaf nearly closed limit switch input is on and the leaf position is greater than 6 degrees or the leaf nearly closed limit switch input is off and the position is less than 4 degrees.
- ll.
- A: SOUTHWEST NEARLY OPEN LIMIT SWITCH TROUBLE
 - A: SOUTHEAST NEARLY OPEN LIMIT SWITCH TROUBLE
 - A: NORTHWEST NEARLY OPEN LIMIT SWITCH TROUBLE
 - A: NORTHEAST NEARLY OPEN LIMIT SWITCH TROUBLE
 - C: The leaf nearly open limit switch input is on and the leaf position is greater than 70 degrees or the leaf nearly open limit switch input is off and the position is less than 65 degrees.
- mm.
- A: SOUTHWEST FULL OPEN LIMIT SWITCH TROUBLE
 - A: SOUTHEAST FULL OPEN LIMIT SWITCH TROUBLE
 - A: NORTHWEST FULL OPEN LIMIT SWITCH TROUBLE
 - A: NORTHEAST FULL OPEN LIMIT SWITCH TROUBLE
 - C: The leaf full open limit switch input is on and the leaf position is greater than 75 degrees or the leaf full open limit switch input is off and the position is less than 73 degrees.

- nn. A: SOUTHWEST POSITION SENSOR TROUBLE
A: SOUTHEAST POSITION SENSOR TROUBLE
A: NORTHWEST POSITION SENSOR TROUBLE
A: NORTHEAST POSITION SENSOR TROUBLE
C: The Drive M-SE-N/M-SE-S Running or Drive M-SW-N/M-SW-S Running or Drive M-NW-N/M-NW-S or Drive M-NE-N/M-NE-S Running input is on and the leaf position value is less than the full closed value or the greater than the full open value.
- oo. A: MAIN BREAKER OPEN
C: The main breaker closed input is off.
- pp. A: BRIDGE ON GENERATOR POWER
C: The ATS generator power input is on.
- qq. A: GENERATOR TROUBLE
C: The generator trouble input is on.

F. Shop Testing

1. Prior to shipment, the control system shall be inspected and witness tested by the Engineer. The shop tests shall include as a minimum the complete simulation of normal operation and bypass functions. All control panels and control desk shall be connected, field inputs shall be simulated by toggle switches and outputs simulated by indicator lights. The Contractor will provide a test plan and test procedure for approval 30 days prior to start of shop test. The shop test procedure is not acceptable for the field test procedure.

G. Installation

1. Install the control system as shown in the Plans and Special Provisions.

H. Field Testing

1. The Contractor shall demonstrate, to the Engineer, the correct operation of all bridge functions and indications. The Contractor will provide a test plan stating how the test is to be performed and how the individual system faults will be simulated, and a test procedure stating all the steps to operate the bridge functions for approval 30 days prior to start of field test. Testing shall include verification of all interlocks and emergency stop circuits. Out-of-sequence testing shall be performed to verify all interlocks are working. Testing shall be performed to verify interlocks are fail-safe. Testing in this section shall be in addition to the requirements of the specification's Special Provisions Section "ACCEPTANCE TESTING".

IV. METHOD OF MEASUREMENT

- B. The various electrical items will be measured as follows:

Pay Item	Pay Unit
Leaf Main Drive Motors	Lump Sum
Vector-Controlled Motor Drives	Lump Sum
Submarine Cables	Lump Sum
Acceptance Testing	Lump Sum

VI. BASIS OF PAYMENT.

A. Payment will be made under:

Pay Item	Pay Unit
Integrated Bridge Controls System	Lump Sum

SERVICE EQUIPMENT

I. DESCRIPTION.

- A. This Section includes furnishing and installing switchboards and service entrance equipment.
- B. Codes, Standards and Specifications.
 - 1. Codes, standards and specifications referenced in this Specification are to be the latest edition in effect at the time the work is being done unless otherwise noted, and are considered to be a part of this Specification as applicable.
 - a. National Electric Manufacturers Association (NEMA):
NEMA PB-2 - Switchboards.
 - b. American National Standards Institute (ANSI):
ANSI No. 61.
 - c. Institute of Electrical and Electronic Engineers (IEEE).
 - d. Underwriters Laboratories, Inc. (UL):
UL-891 Deadfront Switchboards.
 - e. Commonwealth Edison (ComEd) specification for electrical service and metering.

C. SUBMITTALS.

1. Submit the following in accordance with Section 801 and the requirements of this Section:
 - a. Product data for each product specified.
 - b. Shop drawings of switchboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
 - 1) Enclosure type with details.
 - 2) Bus configuration and current ratings.
 - 3) Short-circuit current rating of switchboard.
 - c. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
 - d. Wiring Diagrams, both elementary and schematic, differentiating between manufacturer-installed and field-installed wiring.
 - e. Manufacturer's certification: Signed by the manufacturer certifying that they comply with the Specification requirements. Upon request submit evidence of experience.
 - f. Product Certification: Signed by manufacturer of equipment certifying that products comply with the Specification requirements.
 - g. Installers Certificates: Signed by the Contractor, certifying that the installers comply with the Specification requirements.
 - h. Field testing organization certificates: Signed by the Contractor, certifying that the organization complies with the Specification requirements.
 - i. Report of Field Tests: Certified copies of field tests.
 - j. Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual.

II. MATERIALS.

A. Switchboards.

1. General
 - a. Switchboards shall be designed, manufactured, assembled and tested within the latest applicable standards of NEMA PB-2, ANSI, UL-891 and IEEE.
2. Enclosure
 - a. Switchboards shall be NEMA 12, dead front type, front and rear accessible, completely metal enclosed, self supporting, and shall have the required number of vertical sections bolted together to form one rigid switchboard. Formed removable covers shall be supplied on the rear and sides to totally enclose the switchboard assembly. All doors shall have continuous hinges. Each switchboard section shall have a bottom barrier and an individually removable top plate for installation of conduits or bus ducts.
 - b. Plates and covers shall be fabricated from No. 12 U.S.S. gauge sheet steel. The frame structure members shall be die formed, No.12 U.S.S. gauge steel bolted together and reinforced at corners with rugged gussets internal and external to the structure members. Ventilation openings shall be provided where required. Openings shall be equipped with washable filters. Vertical sections shall be completely factory assembled, wired and tested before delivery to the job site. Each individual vertical section shall be provided with adequate lifting means and shall be capable of being rolled, jacked and moved into the room. They shall be bolted to the structural channels, assembled and bolted together to form a rigid metal enclosure with the only electrical connection being the incoming main conduit and load feeders or feeder bus and bus splice plates.
 - c. Vertical sections shall align front and rear. The entire switchboard and devices shall be rated for the available short circuit current. Each switchboard, as complete unit, shall be given a single short circuit current rating by the manufacturer. Such ratings shall be established by actual tests performed by the manufacturer in accordance with UL specifications on equipment constructed similarly to the subject switchboards under this Contract.
3. Bussing
 - a. Busses, including the ground busses, in the switchboards shall be high grade, hard drawn, silver-plated copper of 98% conductivity and shall have a current density not to exceed 800 amperes per square inch of cross section based on the frame size of the main circuit disconnect. All through-bus tap connections and joints

shall be tightly clamped to insure maximum conductivity. The clamping shall be accomplished with hex head through bolts, nuts and Belleville washers made of nonmagnetic stainless steel, protected by insulating caps.

- b. Furnish and install ground bus in each vertical section structure, extending the entire length of the switchboard. Vertical sections shall be completely bussed with provisions for the addition of future branch devices and vertical sections requiring only the addition of branch circuit breakers or vertical sections as required. Device mounting bolts and bus connecting straps shall be supplied with the future devices. All busses shall be designed to carry rated current without exceeding maximum temperature rise as specified by the IEEE and NEMA. The busses shall be mounted in high impact, heavy fiberglass case supports in each cell, and shall be suitably braced to withstand the mechanical forces exerted during short-circuit conditions.
- c. Furnish and install device bus connection adaptors and straps with required mounting hardware shall be provided for all devices and switchboard components. Bus arrangement, as viewed from the front, shall be A-B-C type, left to right, top to bottom and front to rear. Where special circuitry precludes this arrangement, bus bars shall be so labeled.

4. Finish

- a. Paint the switchboard enclosures on all exterior and interior surfaces. The paint shall be two coats of baked light grey enamel, ANSI No. 61, applied by the electro-deposition process over an iron phosphate pre-treatment.

5. Service Entrance.

- a. The incoming service, current transformer and main circuit disconnect compartment sections shall be completely isolated from the feeder sections of the switchboard, both in the device section and the cable section of the cubicle. The cable section shall also be isolated from the main horizontal bus. The isolation shall be provided by fiberglass or glass reinforced polyester barriers.

6. Current Transformer Compartment.

- a. Locate the current transformer compartment adjacent to the incoming service entrance section of the switchboard. Equip the compartments with mountings for three window-type current transformers in accordance with the latest Commonwealth Edison

(ComEd) requirements. The compartment shall be barriered and covered with a double hinged door, the inner door to be provided with a hasp for utility sealing provisions.

7. Main Circuit Breakers:

a. The main circuit breaker shall be an individually mounted drawout type electronic-trip power circuit breaker having the following minimum features:

- 1) 100% rated
- 2) 3 pole, 4 wire system
- 3) UL listed
- 4) 100,00A RMS Symmetrical Rating
- 5) Full Function Adjustability

8. Branch Circuit Breakers.

a. Circuit breakers shall be with the operating handle or lever of each breaker accessible without opening or removal of covers except where a door is furnished over the panel. Circuit breakers shall be quick-make, quick-break, electronic trip indicating, current limiting type with frame sizes, trip type and settings as specified by the Designer. The load side mechanical type lugs shall be UL listed for copper cables only.

B. Current Transformer Cabinets and Meter Pans.

1. Current transformer cabinets and meter pans shall conform to standard utility company drawings for the types as required, with continuously welded corners without knockouts. The current transformer cabinets shall be made entirely from No. 10 U.S.S. gauge sheet steel, and the meter pans shall be made from No. 12 U.S.S. gauge sheet steel. Sheet steel current transformer cabinets and meter pans shall be electro-galvanized after fabrication and shall be finished with baked enamel.

III. Construction Requirements

A. Installation.

1. In order to prevent mismatching of the phases in the final connection of the Commonwealth Edison (ComEd) service cables to the Contractor's cables, it will be required that the ComEd identify and tag each service cable with its phase designation. The Contractor shall identify and tag

each cable installed by itself in the current transformer cabinets and service end boxes with its phase identification. The Contractor shall further verify that the ComEd cables are connected to the Contractor's cables so that their phase identities correspond respectively to each other.

2. Provide all equipment, except the current transformers and meters, and make all installations and connections, except the connections to the incoming ComEd cables and meters. The current transformers, where required, will be furnished by the ComEd but shall be obtained and installed by the Contractor. The meters, where required, will be furnished, installed and connected by the ComEd. The leads for the meter connections shall be furnished and installed by the Contractor. All service and metering equipment shall conform to the ComEd's requirements.

B. Fireproofing of Cables.

1. Fireproof all electrical cables where exposed in manholes.
2. Apply approved tape fireproofing in the following manner:
 - a. Wrap two layers of 3" wide approved tape, butt wrapped, with the joints of the two layers staggered approximately one-half the width of the tape.
 - b. Secure ends of fireproofing with 1/16-inch impregnated tying cord, Owens-Corning "fiberglass", or approved equal. Secure duct shields into proper position at the duct entrance with tying cord.

IV. METHOD OF MEASUREMENT

- A. There shall be no individual measurement of items in this section, but measurement shall be for the sum total of all items furnished and installed as described in this section.

V. BASIS OF PAYMENT

- A. The lump sum price for the Pay Item "**SERVICE EQUIPMENT**" shall include all items indicated for this specification, unless otherwise noted.

PANELBOARDS AND DISTRIBUTION BOARDS

I. DESCRIPTION

- A. This section includes equipment and installation for alternating current (A.C.) panel boards and distribution boards rated 600 Volts AC (VAC) or less.

- B. Scope of work.
1. Furnish and install lighting and power panel boards, switchboards and associated auxiliary equipment rated 600VAC or less.
- C. Codes, Standards and Specifications.
1. Codes, standards and specifications referenced in this Specification are to be the latest edition in effect at the time the work is being done unless otherwise noted, and are considered to be a part of this Specification as applicable.
 - a. Underwriters Laboratories, Inc. (UL):
 - UL 50 Cabinets and Boxes.
 - UL 67 Panel boards.
 - UL 891 Dead front Switchboards.
 - b. National Electrical Manufacturers Association (NEMA):
 - NEMA AB1 - Molded Case Circuit Breakers and Molded Case Switches.
 - NEMA PB 1 – Panelboards.
 - NEMA PB 2- Switchboards.
 - c. Federal Specifications (FS):
 - W-C-375B/GEN - Molded Case Circuit Breakers.
 - W-P-115 B Type 1 Class 1 - Circuit Breaker panelboards.
 - d. International Electrical Testing Association (NETA):
 - Acceptance Testing Specifications (ATS) for Electrical Power Distribution Equipment and Systems.
- D. Submittals.
1. Submit the following in accordance with the requirements of this Section:
 - a. Product data for each product specified.
 - b. Shop drawings of panel boards and switchboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

- 1) Enclosure type with details.
 - 2) Bus configuration and current ratings.
 - 3) Short-circuit current rating of panel board or switchboard.
 - 4) Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
- c. Wiring Diagrams, both elementary and schematic, differentiating between manufacturer-installed and field-installed wiring.
- d. Manufacturer's Certification: Signed by the manufacturer certifying that they comply with the Specifications requirements. Upon request submit evidence of experience.
- e. Product Certification: Signed by manufacturer of equipment certifying that products comply with the Specification requirements.
- f. Installers Certificates: Signed by the Contractor, certifying that the installers comply with the Specification requirements.
- g. Field testing organization certificates: Signed by the Contractor, certifying that the organization complies with the Specification requirements.
- h. Report of Field Tests: Certified copies of field tests.
- i. Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual.

II. MATERIALS

A. Distribution Boards and Panelboards.

1. Boxes and Trim.

- a. Distribution and panelboard enclosures (consisting of box, trim, doors, plates, etc.) shall be surface or flush mounted. Enclosures shall be NEMA 12 or as indicated on plans. Enclosures shall be manufactured by Square D Company, or approved equal. Enclosure boxes, doors and plates shall each be constructed of sheet steel or stainless steel (as required) in one piece with continuously welded corners. Steel enclosures shall be electro galvanized after fabrication. Steel board boxes larger than 30-inches wide shall be constructed of galvanized steel in lieu of electro galvanizing after fabrication. Appendages including plates,

hinges and mounting studs shall be welded without exterior marks. The door shall have a minimum of two hinges with stainless steel pins. A welded bead shall inhibit the hinge pin from removal. The mechanism shall be semi-flush-mounted with no protruding parts. Furnish five nickel silver keys with each board lock. Single point catch mechanisms shall not be accepted. Interior trim shall be dead front to completely enclose bus compartment and wire gutters with cutouts for board circuit breakers.

- b. Each exterior trim shall have the board designation and utilization voltage clearly indicated.
- c. Finish the boxes, trims and doors on both sides.
- d. Box flange shall be gasketed with 1/8-inch thick black neoprene, at least one-inch wide.
- e. A directory frame made of brass or oxidized copper, with "Lucite" cover, shall be mounted on the inside of the board doors.

2. Bus and Overcurrent Protective Devices.

- a. Panel board and distribution board enclosures, bus structures, main lugs and main breakers shall be manufactured by Square-D Company or approved equal. Current ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed a 50 degree C rise above ambient, in accordance with Underwriters Laboratories Standard UL 67. Bus bar connections to circuit breakers shall be "distributed phase" or "phase sequence" type. The neutral bus bar shall be full size with suitable lugs for feeders. All current carrying parts of the bus shall be hard drawn copper, silver plated at contact surfaces. Bus bracing shall be equal to or greater than the lowest AIC rating of any circuit breaker in the panel.
- b. Panelboards shall be designed for three phase, four wire, 208/120VAC or 480/277VAC as required.
- c. Apparatus, devices and parts of the panel boards shall be securely fastened to the base. The boards shall be constructed and installed in such a way that no bolts, screws or other grounded metal parts shall project inside the breaker or bus compartments. Screws and bolts on the backs of these boards shall be countersunk and covered with an approved insulating compound.
- d. Solid copper neutral assemblies shall be insulated from ground. Circuit breaker enclosures shall be grounded by means of a

continuous copper ground to all conduit-bushing lugs. Neutral assemblies shall be factory installed in all circuit breaker enclosures.

- e. Circuit breakers for distribution boards shall be quick-make, quick-break, thermal magnetic trip indicating, one, two or three pole molded case type, meeting NEMA Standard AB1 and meet applicable requirements of Federal Specifications W-C-375B/GEN, as manufactured by Square-D Company or approved equal. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position. Trip indication shall be clearly shown by the breaker handle. Provisions for additional circuit breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall have a minimum UL interrupting capacity of 65,000 amps symmetrical or more as per short circuit current calculations. Circuit breakers shall be securely bolted to bus bars—plug-on breakers are not permitted. Distribution boards shall be defined as any panelboard with a main bus rating in excess of 400 amps., or a panel containing a branch circuit breaker greater than 100 amps.
- f. Circuit breakers for panelboards shall be quick-make, quick-break, thermal magnetic trip indicating, one, two or three pole molded-case bolt-on type, meet NEMA Standard AB1 and meet applicable requirements of Federal Specifications W-C-375B/GEN, as manufactured by Square-D Co. or approved equal. Multiple pole breakers shall have a common trip. No handle ties shall be allowed. Single pole circuit breakers shall have a minimum trip setting of 15 Amps., and shall be U.L. listed as “switching breakers” at the panel voltage and carry the SWD marking. Provisions for additional circuit breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall have a minimum UL interrupting capacity of 22,000 Amps. symmetrical or more as required per short circuit current calculations. Circuit breakers shall be securely bolted to bus bars.
- g. Provide locking devices with padlocks on circuits for photocell control for exterior lights.

III. CONSTRUCTION REQUIREMENTS

A. Installation.

- 1. To prevent mismatching of the phases in the final connection of the ComEd service cables to the Contractor's cables, it will be required that the ComEd identify and tag each service cable with its phase designation.

The Contractor shall identify and tag each cable installed by itself in the current transformer cabinets and service end boxes with its phase identification. The Contractor shall further verify that the ComEd cables are connected to the Contractor's cables so that their phase identities correspond respectively to each other.

2. Install switchboard and all equipment, except the current transformers and meters, and make all installations and connections, except the connections to the incoming ComEd cables and meters. The current transformers, where required, will be furnished by the ComEd but shall be obtained and installed by the Contractor. The meters, where required, will be furnished, installed and connected by the ComEd. The leads for the meter connections shall be furnished and installed by the Contractor. All service and metering equipment shall conform to the ComEd's requirements.
3. Install panel boxes on channels, Thomas and Betts "Kindorf" type B-900 Series or approved equal, unless otherwise indicated. Furnish and install steel supporting framework.
4. A circuit designation card of good quality heavy paper, which shall bear the number, description and KVA or KW load of each circuit, shall be installed in the directory frame.
5. Panel boards shall be mounted in an approved manner and shall be easily removable as complete units for repair or replacement.
6. Secure conduits entering the board boxes with locknuts and insulated ground bushing, O.Z. Gedney, Type "HBLG", or approval equal. All type "HBLG" ground bushings shall be grounded to the boxes with a No. 4 insulated stranded copper wire, insulation colored dark green. Secure conduits entering weatherproof equipment with cadmium plated watertight hubs, Thomas and Betts Company Series 370, or approved equal, on the outside, and insulated ground bushings on the inside.
7. For 30-ampere branch circuit breakers, or less, the branch circuit wires shall be connected to the load side of the breaker with Thomas & Betts Co., self insulated, ring-type, Sta-Kon terminals, or approved equal, where no built-in pressure wire terminal is furnished. Samples of all sizes of ring type, wire terminals shall be submitted for approval before installing. Sta-Kon terminals shall be installed with a Thomas & Betts Co, Sta-Kon tool, Cat. No. WT-145A, or approved equal. For 40 ampere branch circuit breakers and larger, the branch circuit wires and cables shall be connected to the pressure terminal on the load side of the breaker. Panel board feeder cables shall be connected to the terminals on the line side of the panel board main breaker. Those boards with main lugs only shall have their feeder cables connected to the main buses with

solderless lugs. Solderless lugs shall be O.Z. Gedney two-hole Type "XLH", or approved equal, except where cables smaller than No. 4 A.W.G. are to be installed. In this case, O.Z. Gedney one-hole Type "XL" lugs, or approved equal, shall be installed together with copper bus lug stops for bus copper to prevent lugs from turning and decreasing electrical clearances between live parts.

8. Where branch circuit and main feeder wire and cable sizes exceed the maximum wire and cable sizes that will fit the circuit breakers, the maximum size wire and cable shall be installed at the circuit breakers and connected to the branch circuit and main feeder wire and cable in sizes as required. These connections shall be made in the wiring gutter with OZ/Gedney Type "XTP" parallel gutter taps, or approved equal, taped as specified in Section 16G, Paragraph 3.3, Splices. Cutting and paring of strands to allow wire and cable to fit circuit breakers is not permitted.
9. Conduit entry into enclosed circuit breakers or panels shall be as indicated in NFPA 70, Article 373 "Cabinets, Cutout Boxes, and Meter Socket Enclosures" and Article 374 "Auxiliary Gutters". Discrepancies arising between those Articles and the Contract Documents shall be brought to IDOT's attention in a formal manner during the approval process.

B. TESTING

1. Visual and Mechanical
 - a. Operate switchboard equipment and panelboard circuit breakers to ensure proper and smooth operation.
2. Electrical Tests.
 - a. Perform contact-resistance test of switching equipment.
 - b. Perform insulation resistance test at 1000 Volts D.C. Insulation resistance shall not be less than 100 mega ohms.
 - c. Testing shall be witnessed by IDOT inspectors.

IV. METHOD OF MEASUREMENT

- A. Payment for the Pay Item "PANELBOARDS AND DISTRIBUTION BOARDS" shall be made on a lump sum basis.

V. BASIS OF PAYMENT

- A. The lump sum price for the Pay Item "**PANELBOARDS AND DISTRIBUTION BOARDS**" shall include all items indicated for this specification, unless otherwise noted.

PACKAGED ENGINE GENERATOR SET

I DESCRIPTION

- A. This section includes requirements for furnishing and installing emergency generators.
- B. Work includes providing all materials, equipment, accessories, services and tests necessary to complete and make ready for operation, an adequately sized diesel engine generator set complete with engine generator, engine driven radiator, batteries, charger, silencer, fuel oil tank, (weatherproof sound attenuated enclosure), vibration isolators, and all required appurtenances and accessories. Refer to appropriate section of specifications for additional requirements.
- C. This Section includes the supply and installation of a skid-mounted, diesel oil fueled, engine generator package including the following:
 - 1. Diesel engine
 - 2. AC Alternator
 - 3. Control Panel.
 - 4. Voltage Regulator
 - 5. Cooling System
 - 6. Batteries
 - 7. Battery Charger
 - 8. Exhaust Silencer
 - 9. Fuel Oil Tank
- D. Submittals
 - 1. Product Data: Include shipping, installed, and operating weights of all major components along with the following product and performance data specific to the generator package and sufficient to verify compliance with specification requirements:
 - a. Make and model of engine
 - b. Gross & net bhp rating of engine
 - c. Engine cylinder bore & stroke (inches)
 - d. Engine speed (rpm)

- e. Piston speed (fpm)
 - f. Brake mean effective pressure at generator full load
 - g. kW rating of generator
 - h. KVA rating of generator, at 0.8 power factor
 - i. Mechanical efficiency at full load
 - j. Cylinder maximum pressure (psig)
 - k. Cooling water flow (gpm)
 - l. Maximum allowable cooling water outlet temperature
 - m. Maximum allowable engine lube oil temperature
 - n. Engine maximum heat rejection at full load
 - o. Fuel oil Consumption at full load (gph)
 - p. Lube oil flow rate at full load (gpm)
 - q. Grade and type of lube oil
 - r. Engine exhaust gas flow rate and maximum temperature
 - s. Engine & radiator coolant flow rate
 - t. Jacket water heater capacity
 - u. Generator short circuit ratio
 - v. Generator over speed limit (%)
 - w. Winding pitch
 - x. Generator stator & rotor test voltages
 - y. Exciter test voltage
- E. Shop Drawings: Show generator package skid layout and location of all piping and electrical interface connections. Include Setting Drawings with dimensions for installing foundation and anchor bolt anchorages.
- 1. Provide drawings for all major components of the packaged generator set including the following:
 - a. Muffler
 - b. Control Panel
 - c. Batteries
 - d. Battery charger
 - e. Engine block heater

- f. Remote control panel
 - g. Remote annunciator
 - h. Engine Generator
 - i. Fuel Oil Tank
2. Wiring Diagrams: Detail wiring for power, signal, control systems, battery charger, engine block heater, remote annunciator, and differentiate between manufacturer-installed and field-installed wiring. Provide interconnection wiring diagrams showing all external connections required, electrical interlock and cut-off switch circuit, and electrical load connection diagram.
- F. Operation and Maintenance Data: For Packaged Engine Generator, include in manuals specified in Division 1.
- G. Manufacturer's certification of prototype testing and manufacturer's published warranty documents.
- H. Codes and Standards
- 1. American National Standards Institute (ANSI):
 - C39.1 – "Requirements for Electrical Analog Indicating Instruments"
 - C50.10 – "Rotating Electrical Machinery – Synchronous Machines"
 - C50.13 – "Requirements for Cylindrical Rotor – Synchronous Generators"
 - 2. American Society of Mechanical Engineers (ASME):
 - B15.1 – "Safety Standard Mechanical Power Transmission Apparatus"
 - B40.1 – "Gauges – Pressure Indicating, Dual Type, Elastic Element"
 - 3. Building Code of State of Illinois
 - 4. National Fire protection Association (NFPA):
 - 30 - Flammable and Combustible Liquid Code
 - 37 – Standard for Installation and Use of Stationary Combustible Engine & Gas Turbine
 - 110 – Standard for Emergency and Standby Power Systems
 - 5. Underwriter's Laboratories (U/L):
 - Sub-Base Tanks

6. Institute of Electrical and Electronics Engineers (IEEE):
 - C37.102 – “Guide for AC Generator Protection”
 - 115 – “Guide: Test Procedure for Synchronous Machine”
 - 126 – “Recommended Specification for Speed Governing of Internal Combustion Engine Generator Units”

I. Performance Requirements

1. Prototype Tests shall have been performed on a complete and functional unit. Component level type tests will not be an acceptable substitute for prototype tests. Prototype testing shall comply with the requirements of NFPA 110 for level 1 system.
2. The following performance requirements are required for the engine generator package:
 - a. Voltage regulation shall be plus or minus 0.5 % for any constant load between no load and rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5 %.
 - b. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
 - c. The engine generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperatures.
 - d. Motor starting capability shall depend upon design of motor HP. The generator set shall be capable of sustaining a minimum of 90% of rated no-load voltage with the specified kVA at near zero factor applied to the generator set.

II MATERIALS

A. Acceptable Manufacturers

1. Diesel Engine Generator sets
 - a. Cummins, Caterpillar, Detroit Diesel
 - b. Or approved equal

2. Enclosure
 - a. International Supply Co.
 - b. Pritchard Brown
 - c. Or approved equal
3. Governors
 - a. Woodward
 - b. Or approved equal
4. Exhaust Silencers
 - a. Nelson
 - b. Harco
 - c. Maxim
 - d. Or approved equal
5. Chargers
 - a. Nife
 - b. Charles
 - c. Or approved equal
6. Batteries
 - a. Nife
 - b. Or approved equal
7. Isolators
 - a. Mason
 - b. Vibration Mountings
 - c. Or approved equal
8. Radiators
 - a. Amercool

- b. Modine
- c. Or approved equal

9. Generators

- a. Century
- b. Kato
- c. Or approved equal

10. Regulators

- a. Caterpillar VR3
- b. Basler
- c. Or approved equal

B. Engine

1. The engine shall be in-line, 4-cycle, water-cooled, industrial type Diesel engine. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
2. Minimum displacement shall be 1860 cubic inches, with 12 cylinders. Cylinder blocks shall be cast iron with replaceable liners.
3. Crankshaft shall be forged steel, integral counterweight type. Connecting rods to be forged steel with I-beam design.
4. Fuel System shall use No. 2 Diesel Fuel Oil, with fuel filters and automatic electric fuel shutoff.

C. Engine Accessories

1. An electric governor system to provide automatic isochronous frequency regulation.
2. Skid-mounted radiator and fan cooling system rated for full load operation in 122⁰ F ambient temperature as measured at the generator air inlet. Radiator shall be provided with a duct adaptor flange. The cooling system shall be filled with a 50/50 ethylene glycol / water solution supplied by the equipment supplier.
3. An electric starter capable of three complete cranking cycles without overheating.

4. Positive displacement, mechanical, full pressure, lubricating oil pump.
5. Provide two (2) full-flow lubricating oil filters with replaceable, spin-on canister-type elements and dipstick oil level indicator.
6. Replaceable, dry element, air cleaner with restriction indicator.
7. Flexible fuel supply and return lines.
8. Engine mounted battery charging alternator, 45 ampere minimum, along with solid-state voltage regulator.

D. Engine-Generator Skid / Enclosure

1. The engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. Engine-generator shall be supplied within an outdoor, weather-protective enclosure. The enclosure shall be factory-assembled to the engine generator set base and radiator cowling. The housing shall provide ample airflow for generator set operation without overheating. All enclosure doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish-painted with the manufacturer's standard color. Painting process shall meet the following performance requirements:

Primer	0.5 – 2.0 mils
Topcoat	0.8 – 1.2 mils
Gloss	Per ASTM D523-89, 80% +/- 5%, retention after one year to exceed 50%
Crosshatch Adhesion	Per ASTM D3359-93, 4B-5B
Impact Resistance	Per ASTM D2794-93, 120-160 inch-pounds
Salt Spray	Per ASTM B117-90, 1000+ hours
Humidity	Per ASTM D2247-92, 1000+ hours
Water Soak	Per ASTM D2247-92, 1000+ hours

3. Engine-generator enclosure shall provide sound-attenuation. The enclosure shall limit the full-load sound level to a maximum dBA level as per OSHA at any location within 7 meters of the generator set in a free field environment. Acoustic materials used shall be resistant to oil and water.

E. Fuel Oil Tank

1. The engine-generator set shall include a fuel oil day tank of sufficient capacity to feed the generator for 12 hours or a minimum of 1000 gallons, mounted within the sub-base assembly of the generator set. The tank shall be double wall construction with containment capacity sized in accordance with the requirements for U/L listed Sub-base Tanks and Fire Department of

2. the City of Chicago requirements.
3. The tank shall be UL listed and labeled as generator-supporting, double wall tank, as manufactured by Pryco, Inc. or approved equal.
4. The day tank shall be constructed of welded, heavy gauge aluminized steel, pressure tested in accordance with UL requirements.
5. Tank shall include as a minimum the following connections (all threaded connections, except drain fittings shall be located above the normal full level) :
 - a. Fuel level gauge
 - b. Drain fittings with valves (for both primary tank and containment)
 - c. Engine supply and return connections with removable pipe stems
 - d. Normal vent connections
 - e. Fuel inlet fitting
 - f. Fuel return fitting with suction tube to within one inch of tank bottom
 - g. U.L. emergency vent connections
6. The day tank exterior shall be primed and painted with industrial enamel to match the color of the generator.
7. The tank shall be equipped with independent heavy duty float switches.
8. Provide dry contacts for low fuel level, high fuel level, and rupture/leak detection.
9. Provide vent line termination mushroom-type caps for the normal vent connections and pressure relief type caps for the emergency vent connections. The design and labeling of the pressure relief vent caps shall comply with the requirements of NFPA 30.

F. Auxiliary Equipment and Accessories

1. Water Jacket Heater:
 - a. Engine-mounted, thermostatically-controlled, water jacket heater(s) for the engine. The heater(s) shall be sized as recommended by the engine manufacturer.
 - b. The heater(s) shall be sized in accordance with engine manufacturer's recommendations to warm the engine to a minimum of 100 degrees F, in a 40 degrees F ambient, as per the requirements of NFPA 110.

- c. Heaters shall be installed using quick disconnect couplers to allow isolation of the heater during replacement of heater elements without draining the cooling system.
2. Vibration Isolators:
 - a. Vibration isolators shall be spring type with quantity as recommended by the generator set manufacturer. Isolators shall be sized so that natural frequency of springs shall be at least 1 1/2 times the natural frequency of the combined generating set. Spring isolators shall be securely anchored to specified concrete base pad.
 - b. Isolators shall be seismically rated in accordance with Illinois Building Code.
 3. Starting and Control Batteries:
 - a. Starting battery bank, lead acid type, 24 volt DC, sized as recommended by the generator set manufacturer, shall be supplied for the generator set with battery cables and connectors.
 4. Exhaust Silencer:
 - a. Provide an industrial grade exhaust silencer with 1/2" drain plug. Attenuation capability of muffler shall be no less than 35 dB at 250-1000 Hz of noise transmitted from the engine through the exhaust.
 5. Remote Annunciator:
 - a. Provide and install a 20-light LED remote alarm annunciator, with horn, located as shown on the drawings or in a location which can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for Level 1 systems. Additionally the annunciator shall provide indications for high battery voltage, low battery voltage, and loss of normal power to the charger.
 - b. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements.
 - c. Alarm horn shall be selectable for all annunciation points. When switched on, the horn shall sound for first fault, followed by all subsequent faults, regardless of whether the first fault has been cleared, in accordance with NFPA 110, 3-5.6.2.

6. Battery Charger:

- a. A UL listed/CSA certified voltage regulated battery charger shall be provided for the engine-generator set. The charger shall be mounted inside the enclosure. Input AC voltage and DC output voltage shall be as required.
- b. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts for remote indication of:
 - c. Loss of AC power - red light
 - d. Low battery voltage - red light
 - e. High battery voltage - red light
 - f. Power ON - green light (no relay contact)
- g. Analog DC voltmeter and ammeter, 12 hour equalize charge timer, AC and DC fuses shall also be provided on the charger.
- h. Wrenches:
 - i. A set of special wrenches shall be furnished for the proper care and operation of the generator set.

G. Sequence of Operation

- i. Upon power interruption or test mode sequence, operation shall be as follows:
 - a. Control panel signals generator to start upon utility failure or voltage 70% or less of normal.
 - b. Power source transferred from normal to emergency source after at least 90% frequency and voltage of power is generated by emergency source. (Transfer shall be accomplished in no more than ten (10) seconds.
 - c. Control panel transfers load to normal source after an adjustable duration of time (1-30 minutes set by Contractor) after resumption of normal services by utility.
 - d. Engine shall shut down (5) minutes after running with no load serving as a cool down mode.

H. AC Generator

1. The AC Generator shall be a synchronous, four pole, 2/3 pitch, with revolving field. Construction shall be drip-proof with single pre-lubricated sealed bearing. Generator shall be air cooled by a direct drive, centrifugal blower fan. Generator shall be direct connected to engine by flexible drive disc.
2. All insulation system components shall comply with NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 80 °C.
3. The generator shall be capable of delivering rated output (kVA), at rated frequency and power factor, at any voltage not more than 5 % above or below rated voltage.
4. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.
5. The alternator shall have, as a minimum, the following reactance values:

Synchronous Reactance	2.80
Transient Reactance	0.13
Sub-transient Reactance	0.09
Negative Reactance	0.18
Zero Sequence	0.08

I. Controls

1. General:
 - a. The generator set shall be provided with a microprocessor-based control system mounted on the generator set. The system shall provide all automatic starting, local and remote monitoring, and control of the generator set. The control system shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
 - b. The control system shall be UL508 listed, CSA282-M1989 certified, and meet IEC8528, part 4. All switches, lamps and meters shall be oil-tight and dust-tight and the enclosure door shall be gasketed. There shall be no exposed points in the control enclosure (with the door open) that operate in excess of 50 volts.
 - c. The controls shall meet or exceed the requirements of Mil-Std 461C, part 9, and IEC Std. 801.2 and 801.5, regarding susceptibility to conducted and radiated electromagnetic emissions. The entire control system shall be tested in accordance with, and meet the requirements of, IEEE587 regarding voltage surge resistance.

- d. The control system mounted on the generator set shall include the following features and functions:
 - e. Three position control switch labeled RUN/OFF/AUTO.
 - f. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - g. Red "mushroom-head" push-button EMERGENCY STOP switch.
 - h. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
 - i. Push-button RESET switch.
 - j. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
 - k. Push-button PANEL LAMP switch.
 - l. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
2. AC Output Metering:
- a. The generator set shall be provided with a metering set which includes a 2 ½ inch (90) degree scale, a voltmeter, an ammeter, a frequency meter, and a kilowatt (KW) meter.
 - b. The above meters shall be provided with a phase select switch and an indicating lamp for upper and lower scale on the meters. Ammeter and KW meter scales shall be color coded. Readings from 0-90% of generator set standby rating shall be green. Readings from 90-100% of standby rating shall be amber. Readings in excess of 100% shall be red.
 - b. Provide digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages and shall be displayed in all three phase voltages (line-to-neutral or line-to-line) simultaneously.
3. Alarm and Status Message Display:

- a. The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions.
- b. The following alarm and shutdown conditions shall be indicated on a digital display panel:
 - 1) Low oil pressure (both alarm & shutdown)
 - 2) Oil pressure sender failure (alarm)
 - 3) Low coolant temperature (alarm)
 - 4) High coolant temperature (both alarm & shutdown)
 - 5) Engine temperature sender failure (alarm)
 - 6) Low coolant level (alarm or shutdown – selectable)
 - 7) Failure to crank (shutdown)
 - 8) Over-crank (shutdown)
 - 9) Over-speed (shutdown)
 - 10) Low DC voltage (alarm)
 - 11) High DC voltage (alarm)
 - 12) Weak battery (alarm)
 - 13) High AC voltage (shutdown)
 - 14) Low AC voltage (shutdown)
 - 15) Under frequency (shutdown)
 - 16) Over current (warning & shutdown)
 - 17) Short circuit (shutdown)
 - 18) Ground fault (alarm)
 - 19) Overload (alarm)
 - 20) Emergency stop (shutdown)

- c. In addition to the above alarm and shutdown conditions, provisions shall be made for indication of two (2) customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be the same as that used for the above specified conditions.
 - d. The non-automatic indicating lamp shall be red and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
4. Engine Status Monitoring:
- a. The following information shall be available from a digital status panel in the generator control system:
 - 1) Engine oil pressure (psi or kPA)
 - 2) Engine coolant temperature (degrees F or C)
 - 3) Engine oil temperature (degrees F or C)
 - 4) Engine speed (rpm)
 - 5) Numbers of hours of operation (hours)
 - 6) Number of start attempts
 - 7) Battery voltage (DC volts)
 - b. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
5. Control Functions:
- a. The control system provided shall include a cycle cranking system which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each with 15 second rest period between cranking periods. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
 - b. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control

engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

- c. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

6. Alternator Control Functions:

- a. The generator set shall include an automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and shall provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with alpha-numeric LED readout to indicate setting level. The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching. Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.
- b. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded
- c. An AC over/under voltage monitoring system which responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

- d. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.
 - e. When required by National Electrical Code, the control system shall include a ground fault monitoring relay. The relay shall be adjustable from 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay which will function correctly in system as installed.
7. Control Interfaces for Remote Monitoring:
- a. All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system: Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
 - b. A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

III CONSTRUCTION REQUIREMENTS

A. General

1. Contractor shall install equipment on vibration isolators. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
2. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections, under the supervision of the equipment supplier.

3. All equipment shall be installed so that no appreciable amounts of vibration or sound are transmitted to outside of generator room. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
4. Equipment shall be initially started and operated by representatives of the manufacturer.
5. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

B. Welding

1. All welding done under the Contract shall be by a method approved by the Authority and shall conform as to workmanship, testing, qualification of welders, and general requirements with the regulations of the City of Chicago Building Code and with the welding section of the API Std. 1104 or ASME Section 1X, as applicable. All welding shall be done by certified welders and evidence of their certification shall be submitted before commencement of welding.

C. Testing

1. Contractor shall perform all tests in accordance with code requirements and tests as required by the Authority specified. The Contractor shall submit the test procedure for approval.
2. Factory Tests:
 - a. Equipment supplied shall be fully tested at the factory for function and performance.
 - b. The owner may witness factory testing. Supplier is responsible to provide two weeks notice for testing.
 - c. Generator set factory tests on the equipment shall be performed at rated load and unity PF. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.
3. Field Tests
 - a. The Authority shall be notified prior to all generator tests. One completion of system, This Contractor shall operate the system for at least one (1) 8-hour period, during which time he shall arrange for the manufacturer to perform the start-up and adjustment of the controls.

- b. Before final acceptance, this Contractor shall, in the presence of representatives of the Authority, conduct a test to prove automatic operation of the emergency generating system. The test shall demonstrate to the satisfaction of the Authority that the generator can cold-start automatically.
 - c. The Contractor shall be responsible for the existing work and installations which may be disturbed or damaged by tests, or repair and replacement of his own installations and shall cause such installations as are disturbed or damaged to be restored to their original condition at his own expense.
 - d. Performance of electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation.
4. On-Site Acceptance Test:
- a. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.
 - b. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two-hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

D. Training

1. Trained operators for all equipment shall be furnished under this Contract to give operating instructions to Authority personnel eight (8) hours after completion and acceptance of the work under this Contract. In the event of conflict with other Sections of these Specifications or Drawings, the more stringent will govern.

IV. METHOD OF MEASUREMENT

- A. Payment for the Pay Item "PACKAGED ENGINE GENERATOR SET" shall be made on a lump sum basis.

VI. BASIS OF PAYMENT

- B. The lump sum price for the Pay Item "**PACKAGED ENGINE GENERATOR SET**" shall include all items indicated for this specification, unless otherwise noted.
- C. No payment will be made for repair of, or replacement of, damaged material, which was made necessary due to the Contractor's operations.

AUTOMATIC TRANSFER SWITCH

- I. DESCRIPTION
 - A. This Section includes furnishing and installing safety switches and automatic transfer switches.
 - B. Codes, Standards and Specifications.
 1. Codes, standards and specifications referenced in this Specification are to be the latest edition in effect at the time the work is being done unless otherwise noted, and are considered to be a part of this Specification as applicable.
 - a. National Fire Protection Association (NFPA):
 - 1) NFPA 110
 - b. Underwriters Laboratories, Inc. (UL):
 - 1) UL-1008
 - c. National Electrical Manufacturers Association (NEMA):
 - 1) ICS2-447.
 - 2) ICS-1-109.21.
 - 3) KSI-1990 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - d. Institute of Electrical and Electronics Engineers (IEEE)
 - 1) IEEE 241
 - 2) IEEE 446
 - 3) IEEE C37. 90.1
 - C. Submittals.
 1. Submit the following in accordance with Sections 1C, 16B and the requirements of this Section.
 - a. Product data for each safety and automatic transfer switch.
 - b. Shop drawings of automatic transfer switches including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

- 1) Enclosure type with details.
- 2) Features, characteristics, ratings, and factory settings of auxiliary components.
- 3) Wiring Diagrams, both elementary and schematic, differentiating between manufacturer-installed and field-installed wiring.
- 4) Manufacturer's Certification: Signed by the manufacturer certifying that they comply with the Specification requirements. Upon request submit evidence of experience.
- 5) Product Certification: Signed by manufacturer of equipment certifying that products comply with the Specification requirements.
- 6) Installers Certificates: Signed by the Contractor, certifying that the installers comply with the Specification requirements.
- 7) Field testing organization certificates: Signed by the Contractor, certifying that the organization complies with the Specification requirements.
- 8) Report of Field Tests: Certified copied of field tests.
- 9) Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual.

II. PRODUCTS

A. Bypass Automatic Transfer Switches.

1. Furnish and install automatic transfer & bypass-isolation switch (ATS/BPS) system(s) with number of poles, amperage, voltage, withstand and close-on ratings as required. The automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All automatic transfer & bypass-isolation switches and controllers shall be the products of the same manufacturer. Automatic transfer and bypass isolation switch systems shall be ASCO 7000 Series or approved equal.

B. The automatic transfer switches and controls shall conform to the requirements of:

1. UL 1008 - Standard for Transfer Switch Equipment
2. IEC 947-6-1 Low-voltage Switchgear and Controlgear; Multifunction equipment; Automatic Transfer Switching Equipment
3. NFPA 70 - National Electrical Code

4. NFPA 110 - Emergency and Standby Power Systems
5. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
6. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
7. UL 508 - Industrial Control Equipment

C. Mechanically Held Transfer Switch

1. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. The overall contact transfer time in either direction shall not exceed one-sixth (1/6) of a second. The control module shall direct the operation of the transfer switch. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.
2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
3. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
7. The ATS shall be provided with fully rated simultaneously switched neutral transfer contacts. The neutrals of the normal and emergency power sources shall be disconnected before being connected (break-before-make) during the transfer and retransfer operation
8. Solid Neutral Assembly--Not Used.
9. The automatic transfer switches shall be fitted out with copper lugs to terminate incoming and outgoing power conductors. Lugs shall be T&B series 31000 or equivalent.

10. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
11. Automatic transfer switches shall be provided with copper multi-barrel ground lugs, ASCO accessory No. 33BX or approved equal.

D. Bypass-Isolation Switch

1. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.
2. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.
3. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.
4. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.
5. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.
6. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.
7. Designs requiring operation of key interlocks for bypass isolation or ATSS which cannot be completely withdrawn when isolated are not acceptable

E. Microprocessor Controller

1. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
2. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. Frequency sensing shall be accurate to $\pm 0.2\%$. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.
3. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
4. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
5. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - a. IEEE 472 (ANSI C37.90A) Ring Wave Test.
 - b. EN 55011 1991 Class A Conducted and Radiated Emission.
 - c. EN 61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge.
 - d. EN 61000-4-3 Radiated Electromagnetic Field Immunity.
 - e. EN 61000-4-4 Electrical Fast Transient Immunity.
 - f. EN 61000-4-5 Surge Immunity.
 - g. ENV 50141 HF Conducted Disturbances Immunity.

F. ENCLOSURE:

1. The ATS shall be furnished in a NEMA Type 4 Enclosure unless otherwise noted.

2. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.
3. A 3-pole circuit breaker of the required ampere rating and ampere-interrupting-capacity shall be furnished and installed in the enclosure on the generator side. The circuit breaker shall have ground fault protection.

G. CONTROLLER DISPLAY AND KEYPAD

1. A four-line, 20-character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:
 - a. Nominal line voltage and frequency
 - b. Single or three phase sensing
 - c. Operating parameter protection
 - d. Transfer operating mode configuration (Open transition, Closed transition, or Delayed transition).
2. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

H. VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING:

1. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E, 3 ϕ	70 to 98%	85 to 100%
Overvoltage	N&E, 3 ϕ	102 to 115%	2% below trip
Under frequency	N&E	85 to 98%	90 to 100%
Over frequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

2. Pickup and dropout settings shall be fully field adjustable in 1% increments without the use of any tools, meters or power supplies. Repetitive accuracy of settings shall be +2% or better over an operating temperature range of -20°C to 70°C.
3. Three-phase voltage sensing of the reserve source shall be provided, with a pickup adjustable from 85 to 100% and dropout fixed at 84 to 86% of pickup.
4. Equip the automatic transfer switches with close differential relays permitting transfer to reserve source when voltage on any one phase of normal source drops to 90% or less and return to normal source when all phase voltages are 95% or more.
5. Automatic transfer switches shall be equipped with output terminals to signal the actual availability of the normal and emergency sources as determined by the voltage sensing pickup and dropout settings for each source.
6. Repetitive accuracy of all settings shall be within $\pm 0.5\%$ over an operating temperature range of -20°C to 60°C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
7. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC).
8. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

I. TIME DELAYS

1. An adjustable time delay of 0 to 6 seconds, factory set at 1 second, shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, factory set at 0 seconds, for controlled timing of transfer of loads to emergency.
3. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes, factory set at 30 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

5. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:
 - a. Prior to transfer only.
 - b. Prior to and after transfer.
 - c. Normal to emergency only.
 - d. Emergency to normal only.
 - e. Normal to emergency and emergency to normal.
 - f. All transfer conditions or only when both sources are available.
6. Closed Transition Options—Not Used.
7. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
8. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port. Time delays shall be fully field adjustable over the entire range without the use of any tools, timing devices or test kits.

J. ADDITIONAL FEATURES

1. A three position momentary-type test switch shall be provided for the test/automatic/reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
2. A SPDT contact, rated 5A at 30VDC, shall be provided for a low voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool-down setting, regardless of whether the normal source restores before the load is transferred.
3. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of two N.O. contacts, closed when the ATS is connected to the normal source and two N.C. contacts, and closed when the ATS is connected to the emergency source.
4. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

5. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
6. The following features shall be built-into the controller, but capable of being activated through keypad programming or the serial port only when required:
 - a. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
 - b. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.
 - c. An In phase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in phase monitor shall be equal to ASCO Feature 27.
 - d. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.

K. Engine Exerciser

1. The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:
 - a. Enable or disable the routine.
 - b. Enable or disable transfer of the load during routine.
 - c. Set the start time, .time of day, day of week, week of month (1st, 2nd, 3rd, 4th, alternate or every)
 - d. Set the duration of the run.
2. At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

L. System Status

1. The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,
 - a. Normal Failed
 - b. Load on Normal
 - c. TD Normal to Emergency
 - d. 2min15s
2. Controllers that require multiple screens to determine system status, or display "coded" system status messages which must be explained by references in the operator's manual, are not permissible.
3. Self Diagnostics - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
4. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory.
 - a. Event Logging
 - 1) Data and time and reason for transfer normal to emergency.
 - 2) Data and time and reason for transfer emergency to normal.
 - 3) Data and time and reason for engine start.
 - 4) Data and time engine stopped.
 - 5) Data and time emergency source available.
 - 6) Data and time emergency source not available.
 - b. Statistical Data
 - 1) Total number of transfers.
 - 2) Total number of transfers due to source failure.

- 3) Total number of days controller is energized.
- 4) Total number of hours both normal and emergency sources are available

M. WITHSTAND AND CLOSING RATINGS

1. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals.
2. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATS's which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

N. TESTS AND CERTIFICATION

1. The complete ATS shall be factory 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.
2. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
3. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

N. SERVICE REPRESENTATION

1. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
2. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

III. CONSTRUCTION REQUIREMENTS

A. Tests.

1. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all the requirements of this Specification including the following switching abilities:

- a. Overload and endurance at 480 Volts AC per tables 28.1, 28.2, 29.1 and 29.2 of UL 1008 when enclosed according to Paragraph 1.6.
 - b. Temperature rise tests after the overload and endurance tests to confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits.
 - c. No welding of contacts. Transfer switch must be electrically operable to alternate the sources after the withstand of current tests.
 - d. Dielectric tests at 1,960 Volts RMS, minimum after the withstand current tests.
2. All production units shall be subjected to the following factory tests:
 - a. The complete automatic transfer switch shall be tested to insure proper operation of the individual components and correct overall sequence of operation and to insure that the operating time, voltage, frequency and time delay settings are in compliance with the specification requirements.
 - b. The switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.21.
 - c. The control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 472-1974 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

IV. METHOD OF MEASUREMENT

1. Payment for the Pay Item "AUTOMATIC TRANSFER SWITCH" shall be made on "EACH" unit basis.

V. BASIS OF PAYMENT

2. The unit price for the Pay Item "**AUTOMATIC TRANSFER SWITCH**" shall include all items indicated for this specification, unless otherwise noted.
3. No payment will be made for repair of, or replacement of, damaged material, which was made necessary due to the Contractor's operations.

INTERIOR AND EXTERIOR BUILDING LIGHTING AND RECEPTACLES

I. DESCRIPTION.

- A. The work shall consist of furnishing, installing, and placing in satisfactory operating condition the complete Interior and Exterior building lighting and receptacle Systems, as indicated on the Plans, called for in these specifications for a complete piece of work. The work includes the furnishing, installing, testing

and placing in satisfactory operating condition and acceptance by The Department. The Contractor's attention is also directed to the requirements for electrical work appearing in other items of these Specifications.

- B. The Contractor shall be responsible for installation of the lighting and receptacle equipment, conduit/cable, and lighting control.
- C. It is the intent and purpose of these Specifications to cover and include all apparatus and appliances to properly install, wire, connect, equip, test, adjust, and put into approved working order the respective portions of the Lighting and Receptacle system work herein specified. Any incidental apparatus, appliance, material, or labor not herein specifically mentioned or included that may be found necessary to comply with the requirements of the related documents and referenced standards or codes shall be furnished by the Contractor just as if specifically mentioned in these Specifications and without extra cost.
- D. Shop drawings and operation and maintenance manuals shall be provided as specified hereinafter.
- E. The Lighting and Receptacle work shall consist of the following:
 - 1. Furnish and install new outdoor stair lighting in the East Bridge structure as indicated on drawings.
 - 2. Furnish and install new indoor lighting in accordance to the Energy Code in each of the East and West Bridge structure's as indicated on drawings.
 - 3. Furnish and install new ground fault circuit interrupting duplex receptacles in weatherproof enclosures.
 - 4. Furnish and install new conduit and wiring for lighting and receptacle system in each of the East and West Bridge structures as indicated on drawings.

II. MATERIALS

- A. Conformance
 - 1. All lighting and receptacle equipment and its installation shall conform to the requirements of the latest revision of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials, except as may be otherwise provided herein.
 - 2. Materials and construction shall conform to the requirements of the current National Fire Protection Association (NFPA 70) National Electrical Code, Underwriters Laboratories, Inc. (UL) Standards, National Electrical Manufacturers Association (NEMA) Standards, Chicago Electrical Code, American National Standards Institute (ANSI) Standards, Illuminating

Engineering Society (IES), Illinois State Energy Conservation Construction Code as applicable and to any applicable local rules and ordinances. The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

B. Equipment and Material Provisions

1. All equipment and materials shall be new. All equipment, materials, and workmanship shall be first-class in every particular and shall be manufactured and erected to the satisfaction of the Engineer. The Contractor shall warrant the in-service working of the Lighting and Receptacle system installations for one year or the manufacturer's warranty period, whichever is greater, following project acceptance by The Department. If the Contractor has any objection to any feature of the Lighting and Receptacle system equipment as designed and laid out, he must state his objection at once in writing to the Engineer prior to fabrication and/or installation, otherwise his objection will be ignored if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus. Changes shall be made at the discretion of the Engineer.
2. Each Lighting luminaire shall have a corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, maintenance emergency call number, the name tag of the electrical circuit feeding this equipment (e.g. LP-E1 ckt#1),etc.
3. All metal parts of the installation, except structural steel, shall be of corrosion-resisting material, such as bronze or stainless steel. Malleable iron or steel with a hot-dip galvanized finish shall be used where specified herein. Structural steel shall conform to the requirements given under "Structural Steel".
4. All mounting hardware and all wire and cable terminals shall be vibration proof.
5. If any changes from the Plans or these Specifications are deemed necessary by the Contractor, details of such changes and the reasons therefore shall be submitted for approval as soon as practicable, but before the first submittal. No such changes shall be made nor work started without approval of the Engineer.
6. The Lighting system vendor shall provide a field service staff having the capability of providing services for field coordination. Upon final acceptance of the bridge by The Department, the contractor's staff shall provide on-call warranty service for a period of one year. Field staff shall be capable of responding to an emergency within eight (4) hours.
7. The Contractor shall receive acceptance and approval from The Department (IDOT) for the lighting and receptacle system prior to the warranty is taken into effect.

i. Electrical Items Covered In Other Sections of These Specifications

- SECTION 801 – ELECTRICAL REQUIREMENTS
- SECTION 811 – EXPOSED RACEWAYS
- SECTION 813 – JUNCTION BOXES
- SECTION 817 – CABLE IN RACEWAY

III. CONSTRUCTION REQUIREMENTS.

A. General

1. This Section includes furnishing and installing lighting fixtures with supports and accessories.
2. The requisite number of lamps and ballasts shall be furnished and installed for all lighting fixtures.

B. Codes, Standards and Specifications.

- i. Codes, standards and specifications referenced in this Specification are to be the latest edition in effect at the time the work is being done unless otherwise noted, and are considered to be a part of this Specification as applicable.

1. Illuminating Engineering Society (IES).
2. Illinois State Energy Conservation Construction Code.

C. Submittals.

1. Submit the following:
 - a. Product data for each product specified.
 - b. Shop drawings of each lighting fixture including dimensions and accessories.
 - c. Complete photometric data and distribution curves for each lighting fixture.
 - d. Fixture schedules including voltage, lamp type and area utilized.
 - e. Manufacturer's certification: Signed by manufacturer certifying that they comply with the Specification requirements.

- f. Product Certification: Signed by manufacturer of equipment certifying that products comply with the Specification requirements.
- g. Installers Certificates: Signed by the Contractor, certifying that the installation complies with the Specification requirements.
- h. Aiming and Targeting Plots: Signed by the Contractor, indicating footcandle distribution and fixture alignments to be included for wall mounted exterior type of lighting.
- i. Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual.

D. Products

1. Luminaire Types:

- a. Type "A": Pendant mounted fourteen feet above floor (unless otherwise noted on drawings) industrial grade 175 watt pulse start metal halide luminaire with cast aluminum junction box with baked white powder/polyester finish, electrostatically applied. Luminaire shall be provided with stainless steel external hardware copper free aluminum guard, heat and impact resistant globe for wet locations and reflector. Ballast is suitable for operation at 120 volts, minimum -20 °F starting temperature. Luminaire as manufactured by Killark model VM4P170A2GL+HRD400, or approved equal by Hubbell and Crouse-Hinds.
- b. Type "B": Pendant or surface mounted ten feet above floor (unless otherwise noted on drawings) four foot fluorescent luminaire wired for two 32 watt cool white rapid start T-8 lamps, porcelain enamel steel ventilated reflector, 0 – percent uplight, rigid heavy gauge construction, channel finished high reflectance baked-on white acrylic enamel (89% minimum reflectance) over hot-dip zinc and mill phosphatized, reflector heavily embossed steel, parabolic contour, with porcelain bonded to steel to provide permanent adherence and conforming with PE1-S-100, all hardware cadmium plated for corrosion resistance, end plates of heavy gauge drawn steel with captive hardware, suitable for operation at 120 volts. Luminaire mounted from dual stems from ball-swivel hangers. Luminaire shall be rated for damp locations. Luminaire as manufactured by National Lighting E232-T8-120-EB, or approved equal by Day-Brite and Lithonia..
- c. Type "B-1": Same as "B" with cold temperature ballast, minimum - 20 °F starting temperature.

- d. Type "C": Ceiling recessed 2'x 2' nine cell fluorescent luminaire with two 32W T-8 U shape lamps and electronic dimmable ballast non RF interference type. Reflector shall be formed 20 gauge cold rolled steel. Baked white enamel with 89% reflectivity. The luminaire shall be constructed of all steel parts phosphate treated for corrosion resistance prior to paint procedure then baked with superior adhesion for durability. Suitable for operation at 120 volt. Luminaire as manufactured by National Lighting RPH24-2U32-T8-ET-120-EB-9C, or approved equal by Day-Brite and Lithonia.
- e. Type "D": Surface or pendant mounted ten feet above floor (unless noted otherwise on drawings) wraparound lens type 2'x 4' fluorescent luminaire with two 32W T8 lamps and electronic energy saving ballast non RF interference type. Reflector shall be formed from 20 gauge baked white enamel. Housing shall be formed from 20 gauge cold rolled steel and baked white enamel finish. The luminaire shall be constructed of all steel parts phosphate treated for corrosion resistance prior to paint procedure then baked with superior adhesion for durability. Suitable for operation at 120 volt. Luminaire as manufactured by National Lighting KEX-232-T8-120-EB, or approved equal by Day-Brite and Lithonia.
- f. Type "E": Wall or pendant mounted at a height above door exit sign with battery back-up and six inch letters with $\frac{3}{4}$ " stroke. The single face LED exit sign shall be fully enclosed and gasketed, heavy duty die cast-aluminum construction suitable for cold weather (down to minimum -40 °F starting temperature) and wet locations. The exit sign shall be equipped with battery delivering up to 90 minute capacity to lamps upon loss of power. Exit as manufactured by Lithonia LVSW1R120/277ELNCW, or approved equal by Day-Brite and ---.
- g. Type "E-1": Same as "E" but ceiling mounted.
- h. Type "F": Wall mounted 4' linear fluorescent luminaire with two 32W T8 lamps and electronic energy saving ballast non RF interference type with 6" rounded acrylic diffuser mounted ten feet above floor (unless otherwise noted on drawings). Reflector shall be formed from 20 gauge baked white enamel. Housing shall be formed from 20 gauge cold rolled steel and baked white enamel finish. The luminaire shall be constructed of all steel parts phosphate treated for corrosion resistance prior to paint procedure then baked with superior adhesion for durability. Suitable for operation at 120 volt. Luminaire as manufactured by National Lighting WAFA-232-T8-120-EB-QUARTER, or approved equal by Day-Brite and Lithonia.

- i. Type "G": Wall mounted two head Emergency Battery Unit mounted eight feet above floor (unless noted otherwise on drawings). Battery shall be equipped with trickle charger suitable for operation at 120 volt. The unit shall be fully enclosed and gasketed, heavy duty die cast-aluminum construction suitable for cold weather (down to minimum -40 °F starting temperature) and wet locations. Emergency battery unit as manufactured by Emergi-Lite CC12KSC362, or approved equal by
- j. Type "G-1": Same as "G" but recessed ceiling mounted. Emergency battery unit as manufactured by Emergi-Lite CC12RSC362, or approved equal by
- k. Type "H": Wall mounted suitable for outdoor use luminaire with 175 watt pulse start metal halide luminaire with cast aluminum junction box with baked white powder/polyester finish, electrostatically applied. Luminaire shall be provided with stainless steel external hardware copper free aluminum guard, heat and impact resistant refractor suitable for wet locations and with internal reflector. Ballast is suitable for operation at 120 volts, minimum -20 °F starting temperature. Luminaire is mounted twelve feet above stair landing (unless otherwise noted on the drawings). Luminaire as manufactured Killark model KWPP170, or approved equal by Hubbell and Crouse-Hinds.

2. Switches and wiring devices:

- a. Unless otherwise noted, all lighting switches shall be heavy-duty, industrial/institutional grade. Lighting switches shall be of the toggle quit type Single-pole toggle type switch, 20 Amp, 277 VAC with back and side wired grounding screw. All lighting switches surface-mounted in wet locations shall be furnished with and installed in copper-free cast aluminum type boxes, and shall be furnished and installed with weatherproof cover plates. As manufactured by Leviton catalog # 18221-I, or approved equal by Hubbell and Pass & Seymour.
- b. Dimmers shall be ivory, 900W rated suitable for 120 volt use and fluorescent dimming, single-pole. As manufactured by Leviton catalog # 26666-31, or approved equal by Hubbell and Pass & Seymour.
- c. Unless otherwise noted, all receptacles shall be heavy-duty, specification grade. Heavy-duty ground-fault-current-interrupting (GFCI) industrial grade duplex receptacles: 20A, 125 VAC. All receptacles for use in wet locations shall be furnished with and installed in corrosion-resistant cast aluminum boxes with copper-free die-cast aluminum weatherproof covers suitable for in-use protection. As manufactured by Hubbell model GFR5362ITR, or approved equal by Leviton and Pass & Seymour.

- a. METHOD OF MEASUREMENT.
 - A. The various electrical items will not be measured. Payment will be made based on the amount bid for the item in the proposal.

b. BASIS OF PAYMENT.

- A. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
INTERIOR AND EXTERIOR BUILDING LIGHTING AND RECEPTACLES SYSTEM	Lump Sum

- B. Payment for the INTERIOR AND EXTERIOR BUILDING LIGHTING AND RECEPTACLES System items shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

CCTV DISTRIBUTION SYSTEM
 (July 01, 2009)

DESCRIPTION.

This item shall consist of furnishing, configuring, installing and testing CCTV Dome Cameras and fiberoptic cable system and equipment at the existing IDOT Communication Hut at I-290/I-90-94 Interchange and the Congress Parkway Bridge as shown in the contract plans. It shall also include electrical cables, conduit and equipment and connection to a power supply to energize the camera and camera equipment.

The CCTV (Closed Circuit Television) Distribution System shall be a fully integrated system to collect, manage, transmit, and display CCTV images and control as indicated on the plans and as described herein. It shall integrate with the existing IDOT camera subsystem to provide a completed video and control connection to the IDOT District 1 Communications Center (ComCenter) in Schaumburg as well as matching video images to the IDOT Traffic Systems Center in Oak Park.

The work shall include, but not be limited to furnishing, configuring, testing, and installing various subsystem equipment and connections. It shall also include subsystem equipment and connections at existing facilities in Hillside, the ComCenter in Schaumburg, and the Traffic Systems Center in Oak Park.

The CCTV fiberoptic system shall be a self-contained assembly of rack-mounted components as indicated, integrated and coordinated as required for the defined functionality, complete with all interfaces and interconnecting cabling, suitable for advanced shop staging and testing, as defined elsewhere herein, with other subsystem assemblies. Each shall be installed at its indicated location and connected to power and communications circuits as indicated and as required.

Product information and shop drawings shall be submitted for approval in detail. The submittal shall include, but not be limited to:

- Product information on all components, highlighted to indicate specification compliance.
- Product information that applies to more than a single specific model or variation, and may list optional equipment or features, shall clearly indicate the model, variation and options selected.
- All warranty information.
- Shop Drawings of assemblies of Equipment, with layout and dimensions.
- Interconnection wiring diagrams, indicating all component and cabling identification.
- Interconnection wiring diagrams shall be of such detail that a competent electrician unfamiliar with the equipment is able to properly select and terminate all wiring required for proper system operation.
- Installation drawings, detailing dimensioned placement at facilities and all connections.
- Description of location and arrangements for Shop Staging Tests.

All submitted information shall be provided in both hardcopy and electronic format on CD-ROM.

All equipment, cables, hardware, and all components and material required to produce a complete operating video distribution system in compliance with the Contract Documents shall become and remain the property of the State.

It is not the intent of these specifications to minutely detail the construction of the desired system, but to clearly identify major system components, the system architecture, and to define the performance and functionality that the system shall provide. The Contractor shall provide all equipment, cables, and adapters; patch panels, racks, shelves, drawers and accessories; and other materials and supplies required to produce the desired performance and functionality with the major components and the system architecture as defined, even if they are not specifically identified or implied in the Contract Documents. The Contractor shall provide all labor, programming, configuration, and testing required to produce the desired performance and functionality with the major components and the system architecture as defined and with existing State owned equipment in the ComCenter, Traffic Systems Center, and Hillside hut.

METHOD OF MEASUREMENT:

The CCTV Distribution system shall be counted for payment when furnished and installed, connected, field tested and accepted. A 20% payment will be allowed when the CCTV Distribution System equipment are assembled, delivered to the shop staging location and approved for testing by the Engineer. A 20% payment will be allowed when the 96 fiberoptic cable and patch panels are installed from the Comm Hut to the camera locations and successfully tested with an OTDR and approved by the Engineer. An additional 20% payment will be allowed when CCTV equipment have been connected in simulation and successfully passed shop staging testing as approved by the Engineer. An additional 20% payment will be allowed for equipment as they are installed and made operational at I-290/I-90-94, Hillside,

Traffic System Center and ComCenter. The final 20% payment will be allowed when all equipment have been installed, connected and passed installed operational testing, and when all documentation has been completed, delivered and approved by the Engineer. Normal retainage will apply to all payments.

BASIS OF PAYMENT:

The CCTV Distribution System, operating as an integrated whole, will be paid under pay item CCTV SYSTEM on the basis of the system elements installed as a Lump Sum Item.

Add the following section in the Special Provisions:

CCTV EQUIPMENT

DESCRIPTION.

This item shall consist of furnishing and installing equipment for the control and distribution of CCTV video over fiber optic cable.

The transmission of the video over fiber shall include fiber transceivers at the camera locations as well as video CODECs at location as designated by the Engineer.

CONSTRUCTION REQUIREMENTS

General. The Contractor shall prepare and submit a shop drawing detailing the complete closed-circuit television cabinet equipment installation. The shop drawings shall identify the installation and specifications of all components to be supplied, for approval of the Engineer. Particular emphasis shall be given to the cabling and the interconnection of all of the components.

The Contractor shall demonstrate a prototype assembly using the proposed components. This demonstration shall take place at a Contractor selected and Engineer approved location. These conformance tests shall be completed prior to the delivery of any completed assemblies to the project site. Any deviations from these specifications that are identified during this testing shall be corrected prior to shipment of the assembly to the project site.

Appropriate connectors shall be furnished and installed to interface the in-cabinet components to the integrated dome camera assembly. The Contractor shall mount the in-cabinet components in the equipment cabinet and connect them to AC power, communications, and video feeds.

Testing. The Contractor shall test each installed CCTV Cabinet Equipment. The test shall be conducted from the field cabinet using the standard communication protocol and a laptop computer. The Contractor shall verify that the camera can be fully exercised and moved through the entire limits of Pan, Tilt, Zoom, Focus and Iris adjustments, using both the manual control and presets. In addition, a video monitor and an oscilloscope shall verify that the video signal meets or exceeds the specified requirements.

The Contractor shall repeat the test at the communications shelter, as designated by the Engineer, associated with the CCTV camera. This test confirms the distribution portion of the video circuit, that is, the portion of the circuit from the CCTV camera to the digital video encoder.

The Contractor shall maintain a log of all testing and the corresponding results. A representative of the Contractor and a representative of the Engineer shall sign the log as witnessing the results. Records of all tests shall be submitted to the Engineer prior to accepting the installation.

Documentation. One copy of all operations and maintenance manuals for each CCTV component shall be delivered on CD-ROM.

Warranty. The Contractor shall warranty all materials and workmanship including labor for a period of two years after the completion and acceptance of the installation, unless other warranty requirements prevail. The warranty period shall begin when the Contractor completes all construction obligations related to this item and when the components for this item have been accepted, which shall be documented as the final completion date in the construction status report. This warranty shall include repair and/or replacement of all failed components via a factory authorized depot repair service. All items sent to the depot for repair shall be returned within two weeks of the date of receipt at the facility. The depot location shall be in the United States. Repairs shall not require more than two weeks from date of receipt and the provider of the warranty shall be responsible for all return shipping costs.

The depot maintainer designated for each component shall be authorized by the original manufacturer to supply this service. A warranty certificate shall be supplied for each component from the designated depot repair site indicating the start and end dates of the warranty. The certificate shall be supplied at the conclusion of the system acceptance test and shall be for a minimum of two years after that point. The certificate shall name the Department as the recipient of the service. The Department shall have the right to transfer this service to other private parties who may be contracted to perform overall maintenance of the facility.

Enclosure.

CCTV Cabinet. The CCTV Cabinet, as a minimum, shall be a Hoffman Enclosures Model AxxHyyzzSS6LP, Electromate Enclosures Model E-xxHyyzzSSLP, or approved equal. The cabinet shall be NEMA 4X compliant. The minimum nominal dimensions of the cabinet shall be 24 inches high by 20 inches wide by 10 inches deep. These manufacturers and model numbers are included as a guide to indicate the type of cabinet to be provided and may not be the exact manufacturer and part numbers. Due to contractor selection of equipment to be utilized, the cabinet may need to be larger. The contractor shall be responsible for providing an adequately sized cabinet based on selected equipment, and shall be included in the bid unit price for this item.

The cabinet shall be fabricated of 14 gauge Type 304 or Type 316L stainless steel. All seams shall be continuously welded and ground smooth with no holes or knockouts. The cabinet shall be fabricated with a rolled lip around three sides of the door and on all sides of the enclosure openings to exclude liquids and contaminants. A stainless steel door clamp assembly shall assure a watertight seal. A seamless gasket shall be included to assure a watertight and dust-tight seal.

The cabinet shall have provisions for padlocking in the closed position. The lock shall be Corbin #2 and two keys shall be supplied to the Department with each lock. The keys shall be removable in the locked position only.

A data pocket of high impact thermoplastic material shall be provided. The nominal dimensions of this pocket shall be 12 inches by 12 inches.

Collar studs shall be provided for mounting the stainless steel backboard panel. The cabinet shall be unpainted. Cover, sides, top, and bottom shall have a smooth brushed finish.

Stainless Steel Panel. The cabinet shall be furnished with a stainless steel panel. This panel shall have nominal dimensions of 17 inches by 13 inches. It shall mount on the collar studs fabricated with the CCTV cabinet.

Installation. The cabinet shall be installed as indicated on the detail drawings.

Closed Circuit Television Camera Power Supply.

The Closed Circuit Television Camera Power Supply shall supply power to the camera dome assembly. The requirements include:

Input voltage	120 VAC \pm 10%
Output voltage	24 VAC \pm 10%
Operating Temperature Range:	-40°C to +70°C (minimum)
Storage Temperature Range:	-40°C to +75°C (minimum)

The power supply shall include an AC power indicator with power on/off switch. All outputs shall be fused. The power supply shall be sized for the dome units being supplied, considering pan/tilt, heating, and blower requirements, and shall not be less than 100 VA.

Over-voltage Protection. Over-voltage protection shall be provided on the power conductors, camera control conductors, and the video cables. The specific protection is based on the elements being protected.

Incoming Power Protection. The incoming power shall be protected with a filtering surge protector that absorbs power line noise and switching transients. The specified performance shall be as follows:

Peak current	20 kA (8x20 μ s waveshape)
Life Test	5% change
Clamp voltage	280 V typical @ 20 kA
Response time	\leq 5 ns
Continuous service current	10 amps max. 120 VAC/60 Hz
Operating Temperature	-40°C to +75°C (minimum)
Nominal dimensions	7.15 inches by 3.13 inches by 2.3 inches

Video Cable Protection. The coaxial cable from the camera shall be protected with gas tubes and silicon avalanche devices. The units shall include re-settable fuses to protect against sneak currents. Specific requirements include:

Frequency	0 to 20 MHz
Peak surge current	20 kA (8x20 μ s waveshape)
Technology	Hybrid, solid-state
Attenuation	0.1 dB at 10 MHz
Response time	\leq 1 ns
Protection	Line-to-shield
Input/output connectors	BNC
Impedance	75 ohms
Temperature range	-40°C to +75°C (minimum)
Humidity	0% to 95% (non-condensing)
Clamping voltage	6 V
Nominal dimensions	4.5 inches by 1.5 inches by 1.25 inches

The video cable protector shall be UL listed.

Camera Control Cable Protection. The camera control cable protector shall protect the RS-422/RS-485 signal leads going to the camera dome assembly. Specific requirements include:

Technology	Hybrid, solid-state
Response time	≤5 ns
Protection	Line-to-ground
Input/output connectors	terminal block
Temperature range	-40°C to +75°C (minimum)
Humidity	0% to 95% (non-condensing)
Clamping voltage	7.25 V (maximum); ≤7.0 V (typical)
Nominal dimensions	4.5 inches by 3.3 inches by 1.8 inches

The protector shall protect a minimum of four conductors. [Transmit Data (2 wires) and Receiver Data (2 wires)]

The Contractor shall include all necessary wires and cables necessary to interconnect the components of the CCTV cabinet. The Contractor shall provide a furcation kit to break-out, protect the individual fibers of the 6-fiber cable. The Contractor shall install ST-type connectors on these fibers.

Fiber Optic Video Transceiver Pair. The CCTV Cabinet Equipment shall include two fiber optic video transceiver pairs, one for each CCTV camera, as described herein. To maintain compatibility with the previously installed transceivers on this roadway, the transceiver pair shall be manufacturer by Meridian Technologies, Series DV-1W 1MPS, IFS VT/VR1900 Series, or approved equal by the Engineer. The Approved equal shall be 100% interchangeable with the existing units.

Fiber Optic Video Transmitter. The fiber optic video transmitter shall provide simplex transmission of NTSC video from the CCTV cabinet and duplex communications of camera-control, asynchronous data. Optic video and data transmission shall use one single mode fiber operating in the 1310/1550 nm windows using simple wavelength division multiplexing.

Mechanical and environmental requirements include the following:

Nominal dimensions:	7 inches by 5 inches by 1.5 inches
Operating Temperature Range:	-40°C to +70°C (minimum)
Storage Temperature Range:	-40°C to +75°C (minimum)
Relative Humidity Range	0% to 95% (non-condensing)
MTBF	75,000 hours (minimum)

Optical requirements include:

Connector:	ST
Optical Power Budget: mode fiber	15 dB (minimum) using 9/125 μm single
Operational Wavelengths:	WDM using 1310/1550 nm and a single fiber

Video/data requirements include:

Video connector	BNC
Data connector:	9-pin EIA RS-232, 25-pin EIA RS-232 connector, or terminal block
Data rates	1200-9600 bps, asynchronous
Input signal	0.5 – 2.0 V pk-pk (1 V nominal)/75 ohms impedance
Bandwidth	5 Hz – 7.0 MHz (minimum)
Differential Gain	≤5%
Differential Phase	≤5°
Tilt	≤1%
Signal-to-Noise Ratio	50 dB with 10 dB of attenuation

The equipment shall operate from 120 VAC and include a power supply manufactured by the transceiver manufacturer. Power requirements shall not exceed 15 watts.

The fiber optic video Receiver. The receiver shall receive optical simplex transmission of NTSC video from the CCTV cabinet and shall provide duplex optical communications of camera-control, asynchronous data. Optic video and data transmission shall use one single mode fiber operating in the 1310/1550 nm windows using simple wavelength division multiplexing.

Mechanical and environmental requirements include the following:

Nominal dimensions:	7 inches by 5 inches by 1.5 inches
Operating Temperature Range:	0°C to +70°C (minimum)
Storage Temperature Range:	0°C to +75°C (minimum)
Relative Humidity Range	0% to 95% (non-condensing)
MTBF	75,000 hours (minimum)

Optical requirements include:

Connector:	ST
Optical Power Budget	15 dB (minimum) using 9/125 μm single mode fiber
Operational Wavelengths:	WDM using 1310/1550 nm and a single fiber

Video requirements include:

Connector	BNC
Input signal	0.5–2.0 V pk-pk (1 V nominal)/75 ohms impedance
Bandwidth	5 Hz – 7.0 MHz (minimum)
Differential Gain	≤5%
Differential Phase	≤5°
Tilt	≤1%
Signal-to-Noise Ratio	50 dB with 10 dB of link attenuation

The receivers shall operate from 120 VAC. One 7 slot, 19” rack mount chassis with power supply shall be included in this item to be installed at the Nordic Communications Hut. Only one chassis shall be provided for the total quantity of equipment cabinets.

Video CODEC

Video Encoders and Decoders. Video encoders and decoders (codecs) shall be dedicated hardware devices, and except for differences between encoders and decoders they shall all of the same type from the same manufacturer. The codec shall be a single video channel type to transfer “full motion” 30 frame-per-second high quality D1 color video via H.264, MPEG-4, and MPEG-2 video compression at up to 20 Megabits per second. The units shall operate to produce a robust data communications stream that shall allow for both video and audio transmission and shall be immune to timing disruptions in the existing IP multi-cast system.

The units shall be rack-mountable, or single unit chassis for single unit installation complete with power supplies as required, operating from a 120-volt single phase AC power input. Unit mounted in VCPs or other control building shall include a standard 19” rack with dual redundant power supplies.

Encoder units shall accept NTSC video BNC input, Ethernet RJ-45 communications, and RJ45 serial data input connections.

Approvable codecs shall be compatible with and demonstrably interoperable with the standard codec product of at least one other vendor. Final approval of codec equipment shall be dependent upon a demonstration test of multi-vendor interoperability. Initial submittal information shall include documentation of this interoperability and a demonstration testing plan for approval by the Engineer.

The CODEC encoders shall be Optelecom-NKF series C-60 E-MC, or approved equal by the Engineer. The Approved equal shall be 100% interchangeable with the specified unit with respect to functionality and performance.

The encoders shall interface the serial communications port of the CCTV camera assembly through the fiber optic video link (fiber optic transceivers) where indicated. Using the Ethernet port on the encoder and its IP address, commands shall be exchanged between the camera control computer at the Communications Center and the serial port of the CCTV camera.

Materials shall be supplied to satisfy the following:

VIDEO	Requirements
Video channels	1x PAL/NTSC (Auto/PAL/NTSC)
Input level	1 Vpp (±3 dB)
Compression algorithm	H.264 BP (ISO/IEC 14496-10) MPEG-2 (ISO/IEC 13818-2), MJPEG,MPEG-4 (ISO/IEC 14496-2, ISMA comp.)
Type of streaming	UDP/IP (multi- and/or unicast)
Number of output streams	Up to 20

Input impedance	75Ω/Hi-Z selectable
Video Motion Detection	Yes (user-defined masking)
Encoding latency	<130 ms typ.
Resolution	D1, ½D1, 2CIF, CIF, QCIF, VGA
GOP structure	I, IP (selectable/user profiles)
Frame rate	1 to 30 fps
Quad streaming	1 D1@30fps H264 + D1@30fps MPEG-2+ D1@ 30fps MPEG-4 + CIF@1fps MJPEG
Output data rate	up to 20 Mb/s (CBR or VBR selectable/user profiles)
Video settings	User profiles, contrast, brightness, color saturation, hue, sharpness
On Screen Display (OSD)	3x Text lines (configurable: position, color, border/outline color, font size),1x image in BMP, GIF, or JPEG format (configurable:position, scaling)
Live View Encoder (MJPEG)	HTTP, FTP pull
Connector type	BNC 75Ω (gold plated center pin)

DATA	Requirements
Number of channels	2 (full-duplex)
Number of streams	2x 3 (multi- and/or unicast)
Interfaces	1x RS232
	1x RS422/485 (2- or 4-wire)
Stream	TCP/UDP/MX configurable
Data rate	300 b/s to 230.4 kb/s
Connector type	RJ45

TRANSMISSION	Requirements
Number of interfaces	1
Interface 10/100Base-TX	Fast Ethernet
	Auto Negotiation, half-duplex/full-duplex, 10/100 Mb/SFP option
	Empty SFP slot for 100 Mbps SFP device
Protocols	H. 264 BP, MPEG-4 ES, MPEG-2 TS, MPEG-2 ES, (M)JPEG, RTP, RTCP, RTSP, TCP, UDP, IP, DHCP, IGMPv2,
	(S)NTP, MX/IP, HTTP, SNMP v2, FTP, TelNet, DiffServ, SAP, UPnP
Connector type	RJ45

Management	
LED status indicators	
DC	Power-on indicator (green)
NV	No video on input (red)
SYNC	All links are operational (green); failure in RX stream(s) (yellow); failure in TX stream(s) (red)
Ethernet port	Green LED: on=100 Mb, off=10 Mb; Amber LED: on=link okay, flashes with activity
Network Management & Control	SNMP v2, MX™, HTTP API, HTML (password protected)

Power	
Power consumption	<5W
Rack-mount units	MC 10 and MC11 power supply cabinets
Stand-alone units (/SA)	11 to 19 VDC (PSA-12 DC/25 or PSR-12 DC)

ENVIRONMENTAL	Requirements
Operating temperature	-40° F to +165° F (-40 °C to +74 °C)
Relative humidity	<95%,no condensation.

The CODEC decoders shall be Optelecom-NKF series S-60 D-MC, or approved equal by the Engineer. The Approved equal shall be 100% interchangeable with the specified unit with respect to functionality and performance.

Decoders shall meet the following requirements:

Video	Requirements
Video channels	1x PAL/NTSC (Auto/PAL/NTSC)
Output level	1 Vpp (±3 dB)
Compression algorithm s	H.264 BP (ISO/IEC 14496-10), MJPEG, MPEG-4 (ISO/IEC 14496-2, ISMA comp.)
Type of streaming	UDP/IP (multi- and/or unicast)
Decoding latency	TBD
Resolution	D1, ½D1, 2CIF, CIF, QCIF, VGA
GOP structure	I, IP
Frame rate	1 to 30 fps
On Screen Display (OSD)	3x Text lines (configurable: position, color, border/outline color, font size), 1x image in BMP, GIF, or JPEG format configurable: position, scaling)
Live View encoder (MJPEG)	HTTP, FTP pull
Connector type	BNC 75Ω (gold plated center pin)

Transmission interface	Requirements
Number of interfaces	1
Interface 10/100Base-TX	Fast Ethernet Auto Negotiation, half-duplex/full-duplex, 10/100 Mb
SFP option	Empty SFP slot for 100 Mbps SFP device
Protocols	H.264 BP, MPEG-4 ES, (M)JPEG, RTP, RTCP, RTSP, TCP, UDP, IP, DHCP, IGMPv2,(S)NTP, MX/IP, HTTP, SNMP v2, FTP, TelNet, SAP, UPnP
Connector type	RJ45

Power	Requirements
Power consumption	<5W
Rack-mount units	MC 10 and MC11 power supply cabinets
Stand-alone units (/SA)	11 to 19 VDC (PSA-12 DC/25 or PSR-12 DC)

Management	Requirements
LED status indicators	
DC	Power-on indicator (green)
SYNC	All links are operational (green); failure in RX stream(s) (yellow); failure in TX stream(s) (red)
Ethernet port	Green LED: on=100 Mb, off=10 Mb; Amber LED: on=link okay, flashes with activity
Network Management & Control	SNMP v2, MX™, HTTP API, HTML (password protected)

Environmental	Requirements
Operating temperature	+14° F to +140° F (-10 °C to +60 °C)
Relative humidity	<95% as long as there is no condensation.
MTBF	TBD
Safety & EMC	TBD

Contact Closures	Requirements
Number of channels	2x in, 2x out
Number of streams	2x 3 (multi- and/or unicast)
Output	Fail-safe, potential-free
Connector type	RJ45

Data	Requirements
Number of channels	2 (full-duplex)
Number of streams	2x 3 (multi- and/or unicast)
Interfaces	1x RS232 1x RS422/485 (2- or 4-wire)
Stream	TCP/UDP/MX configurable
Data rate	300 b/s to 230.4 kb/s
Connector type	RJ45

Audio	Requirement
Number of channels	2 (stereo, full-duplex)
Number of streams	3 (multi- and/or unicast)
Maximum bandwidth	20 Hz to 20 kHz
Sampling resolution	8/16-bits linear PCM or G.711
Input level	Adjustable, mic or line
Output level	Adjustable, 3 Vrms max.
Input impedance	>20 kΩ or 600Ω bal.
Output impedance	<100Ω bal.
Connector type	RJ45

The encoders and decoders, codecs, shall be UL listed and be type-accepted to 47 CFR (FCC), Part 15, Type A.

The Codecs shall be the standard product of an established North American manufacturer. The manufacturer shall have been in business for a minimum of 7 years. The manufacturer shall provide a minimum of a twelve (12) month warranty from the date of installation. The manufacturer shall provide technical support via email, fax and telephone. The above forms of support shall be provided Monday through Friday, 8:00am to 5:00pm EST. The Manufacturer shall also have a repair facility within North America.

The units shall be 19-inch rack-mountable. Four complete rack assemblies shall be provided and installed as directed by the Engineer complete with dual redundant power supplies, operating from a 120-volt single phase AC power input

The codecs shall be fully capable of transmitting the PTZ commands of the CCTV camera manufacturer being furnished under this contract as well as existing Philips/Bosch, Pelco, Vicon and Cohu camera commands. Serial data will be transmitted over TCP-IP. Each serial port must support IP addressing with the ability to select the appropriate IP socket number. The codecs must provide the ability to establish an IP connection directly from a workstation to any encoder IP address and socket number to pass serial data. Transmission of serial data must be independent of the video stream. Any serial data conversion required by the codec to communicate to the camera shall be included in this pay item and shall not be paid for separately.

The Encoder/Decoder serial data port must support Multicast data to broadcast a single serial data input to multiple remote encoder serial data port recipient. Bi-directional data must be supported on the codecs.

A demonstration of this low speed serial data transfer shall be required before material submittal approval is given. See submittal requirements in this Special Provision.

Codec operation and management.

Each unit must support a local console accessible using one of the serial interfaces to provide access to all configuration menus of the product including the initial IP address configuration as well as for troubleshooting purposes. The interface must be menu driven for novice users.

All units (encoders and decoders) must support SNMPv2 management protocol to provide the ability to control and monitor all configuration parameters and diagnostics from any 3rd party SNMP management application.

The Encoders/Decoders must support firmware updates from a central site. Updates must be downloadable to a single unit or by bulk via a single command from a firmware utility application via the Ethernet network. The firmware utility application must provide confirmation of the successful and unsuccessful updates. Upon completing of the update, the units must resume to original configuration without the need to reload the unit configuration.

Still Picture Capture

The codec shall be capable of capturing a still image in JPEG format and automatically transferring this image to an FTP site. The resolution of the image shall be user selectable. The frequency of captures shall be user settable and shall as a minimum range from 1 picture every 30 seconds to 1 picture every five minutes.

Still picture logo placement capability. As a part of the still image capture, a graphic overlay image shall be added to the captured image. The graphic image shall be user selectable, in JPEG, BMP or GIF formats. The overlay shall also be user positionable.

Special Submittal Requirements and Operational Demonstration

As a part of the product catalog cut submittal, the Contractor shall provide a demonstration of the codecs at the time of the initial product submittal. The manufacturer shall demonstrate the following interoperability with at least one other codec manufacturer. Compatibility shall also include successful transmission of PTZ commands. The demonstration shall be comprised of the following parts:

- **Codec CCTV camera PTZ compatibility.** The demonstration shall include a pair of the proposed codecs, a proposed CCTV camera, and a CCTV camera of another manufacturer other than the proposed CCTV which is of a manufacturer already installed in the State system.
- **Video interoperability.** The demonstration shall demonstrate the following interoperability: The proposed encoder shall be capable of encoding a video stream that is decodable by at least one other Manufacturer compiling with this specification, or of a manufacturer which equipment is presently in use by IDOT District 1 at the time of bidding. The interoperability demonstration shall be conducted in multicast mode.
- **Software video decoding.** A software based video decoder with PTZ control shall be provided for viewing and controlling a video stream remotely over the IP network.
- **Video snapshot capability.** A fully functional copy of the proposed video snapshot program shall be provided for the demonstration and throughout the 10 day period described herein.

After a successful demonstration of the above requirements, the codec pair shall remain with the Department for 10 working days for further observation. After 10 working days, the Contractor may pick up the codec pair. All costs for this demonstration shall be included in the cost of this pay item. It is the Contractor's responsibly to provide all hardware (including dome CCTV cameras and Ethernet switches) and software to perform the demonstrations as specified.

Four complete codec pairs shall be provided. A codec pair shall consist of one encoder and one decoder. Four complete equipment racks shall be provided as specified elsewhere.

METHOD OF MEASUREMENT:

The various CCTV Equipment will not be measured. Payment will be made based on the amount bid for the item in the proposal.

BASIS OF PAYMENT:

Payment will be made under:

Pay Item
Unit.

Pay

CCTV SYSTEM
Sum

Lump

Payment for the CCTV Equipment shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

ADDRESSABLE FIRE ALARM SYSTEM

I. DESCRIPTION.

- A. The work shall consist of furnishing, installing, and placing in satisfactory operating condition the complete addressable Fire Alarm Systems, as indicated on the Plans, called for in these specifications, or as may be required by the Chicago Building and Fire Code for a complete piece of work. The work includes the furnishing, installing, testing and placing in satisfactory operating condition and acceptance by the Chicago Fire Department. The Contractor's attention is also directed to the requirements for electrical work appearing in other items of these Specifications.
- B. It is the intent and purpose of these Specifications to cover and include all apparatus and appliances to properly install, wire, connect, equip, test, adjust, and put into approved working order the respective portions of the Fire Alarm system work herein specified. The work shall also include all applicable fees required by the Chicago Building and Fire Code and Fire Department. Any incidental apparatus, appliance, material, or labor not herein specifically mentioned or included that may be found necessary to comply with the requirements of the related documents and referenced standards or codes shall be furnished by the Contractor just as if specifically mentioned in these Specifications and without extra cost.
- C. Shop drawings and operation and maintenance manuals shall be provided as specified hereinafter.
- D. The Fire Alarm work shall consist of the following:
 - 1. Furnish and install new addressable Fire Alarm Control Panel (FACP) in each of the East and West Bridge structures as indicated on drawings.
 - 2. Furnish and install new Fire Alarm remote Annunciator panel (ANN) in the vestibule of the East and West Bridge structures as indicated on drawings.
 - 3. Furnish and install new addressable smoke detectors in each of the East and West Bridge structures as indicated on drawings.

4. Furnish and install new addressable heat detectors in each of the East and West Bridge structures as indicated on drawings.
5. Furnish and install new non-addressable heat detectors in each of the East and West Bridge structures as indicated on drawings.
6. Furnish and install new addressable manual fire-alarm boxes in each of the East and West Bridge structures as indicated on drawings.
7. Furnish and install new notification appliances in each of the East and West Bridge structures as indicated on drawings.
8. Furnish and install new addressable interface devices in each of the East and West Bridge structures as indicated on drawings.
9. Furnish and install new offsite notification via a dedicated line in each of the East and West Bridge structures as indicated on drawings.
10. Furnish and install new system printer.
11. Furnish and install new conduit and wiring for initiating devices Class A wiring, Class B wiring and indication devices wiring in each of the East and West Bridge structures as indicated on drawings.

E. Conformance

1. All Fire Alarm equipment and its installation shall conform to the requirements of the latest revision of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials, except as may be otherwise provided herein.
2. Materials and construction shall conform to the requirements of the current National Fire Alarm Code (NFPA 72), National Electrical Code, and to any applicable local rules and ordinances. The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

F. Equipment and Material Provisions

1. All equipment and materials shall be new. All equipment, materials, and workmanship shall be first-class in every particular and shall be manufactured and erected to the satisfaction of the Engineer. The Contractor shall warrant the in-service working of the Fire Alarm installations for one year or the manufacturer's warranty period, whichever is greater, following project acceptance by The Department. If the Contractor has any objection to any feature of the Fire Alarm equipment as designed and laid out, he must state his objection at once

in writing to the Engineer prior to fabrication and/or installation, otherwise his objection will be ignored if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus. Changes shall be made at the discretion of the Engineer.

2. Each FACP and ANN shall have a corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, maintenance emergency call number, the name tag of the equipment (e.g. FACP-E for Fire Alarm Control Panel east), etc.
3. All metal parts of the installation, except structural steel, shall be of corrosion-resisting material, such as bronze or stainless steel. Malleable iron or steel with a hot-dip galvanized finish shall be used where specified herein. Structural steel shall conform to the requirements given under "Structural Steel".
4. All mounting hardware and all wire and cable terminals shall be vibration proof.
5. If any changes from the Plans or these Specifications are deemed necessary by the Contractor, details of such changes and the reasons therefore shall be submitted for approval as soon as practicable, but before the first submittal. No such changes shall be made nor work started without approval of the Engineer.
6. The Fire Alarm system vendor shall provide a field service staff having the capability of providing services for field coordination. Upon final acceptance of the bridge by The Department, the system vendor's staff shall provide on-call warranty service for a period of five years. Field staff shall be capable of responding to an emergency within eight (8) hours.
7. The Contractor shall receive acceptance and approval from the Chicago Fire Department for the installation of the Fire Alarm system in each structure prior to the warranty is taken into effect. This certification shall be presented to The Department for approval of warranty commencement.

G. Electrical Items Covered In Other Sections of These Specifications

1. SECTION 801 – ELECTRICAL REQUIREMENTS
2. SECTION 811 – EXPOSED RACEWAYS
3. SECTION 813 – JUNCTION BOXES
4. SECTION 817 – CABLE IN RACEWAY

H. System Description

1. Non-coded, UL Listed intelligent analog addressable fire alarm system with multiplexed signal transmission.
2. The System supplied under this specification utilizes independently addressed, input/output modules, power supply(s) as described in this specification. The system contains fire alarm control panel, remote annunciator(s) and NAC power supply(s).

I. Submittals

1. The Contractor shall purchase no equipment for the system specified herein until The Department has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The Contractor shall submit three (3) complete sets of documentation within 30 calendar days after award of purchase order.
2. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the Contract Documents. In addition the Contractor shall provide specific notation on each Shop Drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.
3. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Construction Manager.
4. Shop Drawings shall be prepared by persons with the following qualifications:
5. Trained and certified by manufacturer in fire-alarm system design.
6. NICET-certified fire-alarm technician, Level I, II, III, IV minimum
7. Product Data: Product Data sheets with the printed logo or trademark of the manufacturer of all equipment. Indicated in the documentation shall be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Owner.
8. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
9. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72.

10. Include voltage drop calculations for notification appliance circuits.
 11. Include battery-size calculations.
 12. Include performance parameters and installation details for each detector.
 13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
 14. Operation and Maintenance Data: For fire-alarm systems and components to be included in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data, include the following:
 15. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72.
 16. Provide "Record of Completion Documents" according to NFPA72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 17. Record copy of site-specific software database file, hardcopy print-out and CD, with password for delivery to the owner. Proprietary system/service companies will not be acceptable.
 18. Provide "Maintenance, Inspection and Testing Records" according to NFPA72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals (hardcopy) and electronic on CD.
 19. Manufacturer's required maintenance related to system warranty requirements.
 20. Abbreviated operating instructions for mounting at fire-alarm control unit.
 21. Copy of NFPA72.
- J. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application.
5. CD of site-specific software database files with password and electronic product data sheets. Provide hard copy print-out of the software program. Proprietary system/service companies will not be acceptable.
6. Provide a complete system comparison report for each change implemented during the warranty period.
7. Provide a list of global system settings
8. Provide a list of the contents of each system cabinet and their settings
9. Provide a list of all addressable devices with their addresses and settings

K. Quality Assurance

1. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
2. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level I, II, III, IV technician.
3. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA70, by a qualified testing agency, and marked for intended location and application.
5. NFPA Certification: Obtain certification according to NFPA72 in the form of a placard by an approved alarm company.

L. Warranty and Software Service Agreement

1. The contractor shall warranty all materials, installation and workmanship for five (5) years from date of acceptance, unless otherwise specified. A copy of the manufacturers' warranty shall be provided with closeout documentation and included with the operation and installation manuals.
2. The System Supplier shall maintain a service organization with adequate spare parts stocked within 75 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of The Department notifying the contractor.

3. Technical Support: Beginning with Substantial Completion, provide software support for five (5) years, shall be included in this project.
4. Detector Sensitivity Testing: During the warranty period, each year the contractor is to perform detector sensitivity testing and provide report to the Chicago Department of Transportation. Unless, the system is UL Listed to perform automatic sensitivity testing without any manual intervention and should detector fall outside of sensitivity window, the system will automatically indicate a device trouble. A copy of UL letter is to be provided as proof of system operation.
5. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within three (3) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
6. Provide 30 days' notice to Chicago Department of Transportation to allow scheduling and access to system and to allow the Chicago Department of Transportation to upgrade computer equipment if necessary.

II. MATERIALS

A. Extra Materials

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
2. Smoke Detectors, heat detectors, monitor modules and control modules: Quantity equal to 2% percent of amount of each type installed, but no fewer than 2 unit of each type.
3. Keys: Ten extra set for access to locked and tamperproof components.
4. Audible and Visual Notification Appliances: 2% of each type installed.

B. Manufacturers

1. Manufacturers: The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling fire alarm system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
2. The Contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the

requirements of these Specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

3. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the Chicago Department of Transportation. All specified operational features must be met without exception.
4. All control panel assemblies and connected (new) field appliances shall be provided by the same System Supplier, and shall be designed and tested to ensure that the system operates as specified. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.
5. Upon completion of the project The Department shall be provided with a hard copy printout of the system software database and an electronic version of the system program and database with all required passwords.
6. That equipment proposed to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:
 - a. A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by The Department, not less than ten (10) calendar days prior to the scheduled date for submission of bids.
 - b. The supplier of alternate equipment shall furnish evidence that the proposed alternate system performance is equal to or superior than the system operation stated in the specification. Such evidence shall be submitted to The Department, not less than ten (10) calendar days prior to the scheduled date for submission of bids.
 - c. The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any

submission that does not include a point-by-point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

- d. The supplier of alternate equipment shall submit a list from the alternate manufacture on the manufactures letterhead indicating the names and addresses of all authorized suppliers in the area. Proprietary products will not be considered.
 - e. The acceptability of any alternate proposed system shall be the sole decision of The Department or his authorized representative
7. Approved Products: All panels and peripheral devices shall be of the standard product of single manufacturer and shall display the manufacturer's name of each component.

C. Systems operational description

- 1. Fire-alarm signal initiation shall be by one or more of the following devices:
 - a. Manual stations.
 - b. Heat detectors.
 - c. Smoke detectors.
- 2. Fire-alarm signal shall initiate the following actions:
 - a. Activate the audible and visual notification appliances.
 - b. Identify alarm at fire-alarm control unit and remote annunciators.
 - c. Transmit an alarm signal to the remote alarm receiving station.
 - d. Activate emergency shutoffs for gas and fuel supplies.
 - e. Record events in the system memory.
 - f. Record events by the system printer.
- 3. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - a. Valve supervisory switch.

4. System trouble signal initiation shall be by one or more of the following devices and actions:
 - a. Open circuits, shorts, and grounds in designated circuits.
 - b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - c. Loss of primary power at fire-alarm control unit.
 - d. Ground or a single break in fire-alarm control unit internal circuits.
 - e. Abnormal ac voltage at fire-alarm control unit.
 - f. Break in standby battery circuitry.
 - g. Failure of battery charging.
 - h. Abnormal position of any switch at fire-alarm control unit or annunciator.
5. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

D. Fire Alarm Control Unit (FACP)

1. The control panel shall contain a microprocessor with 10/100 ethernet media access controller (MAC). The system shall be designed specifically for fire detection, and notification applications. The control panel shall be listed and approved for the application standard(s) as listed under the General section. As manufactured by GE Security EST IO64, and approved equal by Notifier and Simplex.
2. The control panel shall include all required hardware, software and system programming to provide a complete and operational system. The control panel shall assure that life safety takes precedence among all panel activities.
3. The control panel shall include the following capacities:
 - a. Support up to 64 analog/addressable points.
 - b. Support up to 8 fully supervised remote annunciators.
 - c. Support digital dialer with Contact ID format
 - d. Support up to 1000 chronological events.

4. The control panel shall include the following features:
 - a. Ability to download or upload site applications and system diagnostics remotely through an Ethernet connection, or DACT.
 - b. Provide electronic addressing of analog/addressable devices. Rotary and dip switch addressing shall not be considered equal.
 - c. Provide an operator interface display that shall include functions required to annunciate command and control system functions.
 - d. Provide an internal audible signal with different programmable patters to distinguish between alarm, supervisory, trouble and monitor conditions.
 - e. Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.
 - f. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
 - g. Provide an authorized operator to perform test functions within the installed system.
 - h. The control panel shall provide the following intelligent and intuitive diagnostic software tools.
 - i. Fast Ground Check
 - 1) Allow quick wiring diagnostics for ground faults every 4 seconds to troubleshoot ground faults much quicker and determine if they have been fixed or not.
 - j. Recalibrate Device
 - 1) The control panel recalibrates any devices that have been cleaned. The Recalibrate Device feature will immediately reset the environmental compensation and dirtiness levels for faster verification of cleaned devices.
 - k. Test Fire
 - 1) The control panel sends a test command to a detector or input module to activate. This allows for proper operation and programming testing of the device.

I. Flash Device LED

- 1) It shall be possible to activate any device LED from the control panel menu to help troubleshooting or locate a specific device on a loop.

m. Walk Test

- 1) Walk test will allow the operator to test individual zones or devices without placing an alarm event on the system.
- 2) It shall be possible to perform a walk test in a silent or audible test mode. Silent test mode shall display the test results on the LCD display. Audible test confirmation shall sound a coded signal on the systems NAC circuits.
- 3) It shall be possible to activate Walk Test by zone or device to ensure the balance of the system remains in service to protect the premises.
- 4) It shall be possible to view and print a walk test report showing the activation and restoration of all walk test events.

E. Device Maintenance

1. It shall be possible to view and print a report of all detectors dirtiness levels to optimize cleaning schedules. The report shall filter for all devices, devices that are 20% dirty or devices that are 80% dirty. The report shall show the device, how dirty it is by percentage and its sensitivity setting.
2. Detectors shall automatically send an alert message to the LCD Users Interface and illuminate the service detector LED when they reach 80% dirty and latch a trouble when they reach 100% dirty to ensure maintenance action is performed.

F. Main Operators Display Operations:

1. Provide a discreet system control switch provided for reset, alarm silence, panel silence, remote disconnect, drill switch, and up/down/right/left switches.
2. Backlit LCD display shall be 80 character display.
3. Each point shall have a 40 character custom message.
4. Service Detector LED: Provide indication when a detector needs servicing

5. Programmable Switches: Provide minimum of 2 programmable switches with corresponding LED. The switches shall be programmed for disable/enable or activate restore functions as follows;

- a. Disable NAC
- b. Alarm and Trouble Annunciator: Provide minimum of 16 zones of LED annunciation with red alarm and yellow trouble indicators; 4 zones may be utilized for supervisory zone annunciation. Devices on addressable loop circuits shall be identified by display or their address and by their condition (alarm, pre-alarm, monitor, supervisory, and trouble).
- c. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions
- d. Circuits Requirements:
 - 1) Signaling Line Circuits for Intelligent Analog Addressable Loop:
 - 2) Class A (style 7)
 - 3) Any combination of 64 detectors or modules.
 - 4) Notification Appliance Circuits:
 - 5) Class B (style Y)
 - 6) Maximum circuit loading to 2.5 amps for notification appliance circuits
 - 7) Activation of alarm notification appliances, and other functions shall occur within 3 seconds after the activation of an initiating device.

G. Smoke-Alarm Verification:

1. Initiate an audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.

4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
6. Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change to alternate settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
7. Digital Alarm Communicator Transmitter: The system shall have an integrated off premise communications capability using a digital alarm communications transmitter (DACT) for sending system events to multiple central monitoring station (CMS) receivers. The system shall provide the CMS(s) with point identification of system events using Contact ID protocol. The dialer shall have the capability to support up to two (2) individual accounts and to send account information to two (2) different receivers, each having a primary and secondary telephone access number. System events shall be capable of being directed to one or more receivers depending on event type or location as specified by the system designed. As manufactured by GE-EST model SA-DACT, or approved equal by Notifier and Simplex.
8. Digital data transmission shall include the following (Contact ID)
 - a. Address of the alarm-initiating device.
 - b. Loss of ac supply or loss of power.
 - c. Low battery.
 - d. Abnormal test signal.
 - e. Communication bus failure
9. Ethernet Port: Provide a standard 10/100 Base T Ethernet port for connecting to an intranet or a local network. This connection shall support the downloading of configuration programming to the panel over the network, and provide the capability of diagnostic information from a remote location.
10. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, shall be powered by nominal 24-V dc source.

11. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
12. Secondary Power: Shall provide 24 hours supervisory and 5 minutes of alarm with batteries, automatic battery charger, and automatic transfer switch.
13. NAC Power Supply: The NAC power supply shall be independent unit that will provide power to visual strobe notification appliances. It shall be possible to configure the NAC's to follow the main panel's NAC or activate from intelligent synchronized modules. The booster NAC's must be configurable to operate independently at any one of the following rates: continuous synchronized, or 3-3-3 temporal. Fault conditions on the power supply shall not impede alarm activation of host NAC circuits or other power supplies. The NAC power supply must be able to provide concurrent power for notification devices, security devices, access control equipment and auxiliary devices such as door holders. . All the NAC Power Supplies shall be synchronized. The power supply shall support up to 24 amp hour batteries. As manufactured by GE-EST model BPS16A, or approved equal by Notifier and Simplex.
14. Power supply shall be rated 10 amps minimum and UL 864 Listed.
15. Four independent 3amp NAC circuits. Each being configurable as auxiliary power.
16. All circuits shall be synchronized.

H. System Printer

1. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
2. Each control panel shall be capable of supporting a printer. All control panel printer ports shall be configurable to output any combination of alarm, supervisory, trouble, monitor, or group event messages.
3. Printer shall be GE-EST model PT-1S, or approved equal by Notifier and Simplex.

I. Remote Annunciators

1. Remote LED Annunciators: shall have LED display functions for alarm, supervisory, and trouble indications and common system controls including; acknowledge/silence, signal silence, reset, drill, and lamp test. Annunciator must support a 24 LED expander. Shall be housed in a metal enclosure with key lock door. Annunciator shall be GE-EST, model RLED series, or approved equal by Notifier and Simplex.

J. Manual Fire-Alarm Boxes

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box. Shall be GE-EST, model SIGA-278, or approved equal by Notifier and Simplex.
2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. The manual pull station will have an intelligent module integral of the unit.
4. Station Reset: key operated switch shall match the control panel key.
5. Manual pull stations that initiated an alarm condition by opening the unit are not acceptable.
6. Indoor Protective Shield: Factory-fabricated clear plastic enclosure. Hinged at the top to permit lifting for access to initiate alarm. Lifting the cover actuates an integral battery powered audible horn (when noted on the drawings) intended to discourage false-alarm operation.
7. Weatherproof manual pull station shall be provided of red metal construction with special weatherproof gasket metal red box. Shall be GE-EST, model MPSR1, or approved equal by Notifier and Simplex.
8. Single-action operation.
 - a. Station Reset: key operated switch shall match the control panel key.
 - b. The intelligent monitor module will be located within the building and not with the station

K. Intelligent Analog System Smoke Detectors Requirements

1. Integral Microprocessor: All decisions are made at the detector determining if the device is in the alarm or trouble condition.

2. Non-Volatile Memory: Permanently stores serial number, and type of device. Automatically updates historic information including hours of operation, last maintenance date, number of alarms and troubles, time of last alarm and analog signal patterns for each sensing element just before last alarm.
3. Electronic Addressing: Permanently stores programmable system address. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using switches for addressing shall not be acceptable.
4. Automatic Device Mapping: Each detector transmits wiring information regarding its location with respect to other devices on the circuit, creating an As-Built wiring diagram. This will also provide enhanced supervision of the device physical location and the device message shall reside with the location and not the device address. Devices installed in the wrong location will always report the correct message of the physical location.
5. Sensitivity Range: Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, and less sensitive or least sensitive. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. It shall be possible to program control panel activity to each level.
6. Pre-Alarm: Detector stores 8 pre-alarm sensitivity values to alert local personnel prior to the sensor reaching full evacuation sensitivity. Sensitivity values can be set in 5-10% increments.
7. Environmental Compensation: The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal when the detector reaches 80% compensation has been used. The detector shall provide a dirty fault signal and illuminate Service Detector LED on control panel.
8. Twin Status LEDs: Flashing Green LED shows normal; flashing RED shows alarm state; steady RED and steady GREEN show alarm state in stand-alone mode, visible from any direction.
9. UL Sensitivity Testing: The detector shall utilize a supervised microprocessor that is capable of monitoring the sensitivity of the detector. If the detector sensitivity shifts outside of the UL limits, a trouble signal is sent to the panel.
10. Device Replacement: The system shall allow for changing of detector types for service replacement purposes without the need to reprogram

the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

L. Intelligent Photoelectric Detector

1. Provide intelligent analog addressable photoelectric smoke detectors at the locations shown on the drawings. Shall be GE-EST, model SIGA-PS, or approved equal by Notifier and Simplex.

M. Fixed Temperature Heat Detector

1. Provide intelligent fixed temperature heat detectors at the locations shown on the drawings. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications. Shall be GE-EST, model SIGA-HFS, or approved equal by Notifier and Simplex.

N. Detector Base Types

1. Provide standard detector mounting bases suitable for mounting on 1-gang, or 4inch octagon box and 4 inch square box. The base shall, contain no electronics and support all series detector types. Bases with electronics or dip-switches are not acceptable. Shall be GE-EST, model SIGA-SB or SB4, or approved equal by Notifier and Simplex.
2. Provide relay detector mounting bases (shall be GE-EST, model SIGA-RB or RB4, or approved equal by Notifier and Simplex) suitable for mounting on 1-gang, or 4" octagon box and 4" square box. The relay base shall support all Signature Series detector types and have the following minimum requirements:
3. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
4. The position of the contact shall be supervised.
5. The relay shall automatically de-energize when a detector is removed.

6. The operation of the relay base shall be controlled by its respective detector processor or under program control as required by the application. Detector relays not capable of operational programming independent of the detector shall not be considered equal. Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for "pilot duty".
7. Removal of the respective detector shall not affect communications with other detectors.
8. Provide audible detector mounting bases suitable for mounting on 4" x 4" octagonal concrete ring (mud box) and 4" square x 2-1/8" (54 mm) deep box. Shall be GE-EST, model SIGA-AB4G, or approved equal by Notifier and Simplex.
9. The base shall support all detector types and be capable of single or group operation. The audible base shall emit a temporal alarm tone and be selectable for low or high output.
10. The operation of the audible base shall be controlled by its respective detector processor or under program control as required by the application. Detector audible base not capable of operational programming independent of the detector shall not be considered equal.
11. The audible bases shall be UL268 and UL464 Listed, and provide a reverberant room sound output per UL464 of 81 dBA at 10ft (3m). and an average anechoic sound output of 90 dBA at 10 ft.(3m).

O. Intelligent Modules

1. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller.
2. Integral Microprocessor: All decisions are made at the module determining if the device is alarm or trouble condition. Each module provides its own ground fault detection.
3. Non-Volatile Memory: Permanently stores serial number, and type of device. Automatically updates historic information including hours of operation, number of alarms and troubles, time of last alarm.
4. Automatic Device Mapping: Each detector transmits wiring information regarding its location with respect to other devices on the circuit, creating an As-Built wiring diagram. This will also provide enhanced supervision

of the device physical location. The device message shall reside with the location and not the device address. Devices installed in the wrong location will always report the correct message of the physical location.

5. Twin Status LEDs: The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status.
6. Input and output circuit wiring shall be supervised for open and ground faults.
7. Two styles of modules shall be available, those designed for gang box mounting, and where multiple modules are required in a single location, plug in modules shall be provided with a Universal Input/Output motherboard.
8. Intelligent Input Module. The Input Module shall provide one supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square box with 1-gang covers. Shall be GE-EST model SIGA-CT1 or CT2 or SIGA-MCT2, or approved equal by Notifier and Simplex. The single input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
9. Intelligent Relay Module. Provide addressable control relay circuit modules shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square box with 1-gang covers. Shall be GE-EST SIGA-CR or SIGA-MCR, or approved equal by Notifier and Simplex.
10. NAC Control Module: Provide intelligent NAC control module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. The gang box -mounted version shall be suitable for mounting in North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The plug-In version shall plug into a universal multi-module motherboard. Shall be GE-EST model

SIGA-CC1 or –CC1S or SIGA-MCC1 or MCC1S, or approved equal by Notifier and Simplex. The NAC control module shall support the following operations:

- a. 24volt NAC circuit
- b. Audio notification circuit 25v or 70v
- c. Telephone Power Selector with Ring Tone (Firefighter's Telephone)
- d. Visual Synchronized Output to NAC Power Supply.

P. Notification Appliances

1. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.
2. Any appliances, which do not meet the above requirements, and are submitted, for use must show written proof of they're compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended. All appliances shall be UL listed Fire Protective Service and shall be UL 1971.
3. Notification Appliances – Visual
4. Provide wall or ceiling mounted <red><white> strobes with in-out screw terminals shall be provided for wiring. Strobes shall provide a smooth light distribution pattern field selectable candela 15 cd, 30 cd, 75 cd, and 110 cd (field adjustable) flash output rating. The strobe (15, 30, 75, and 110) candela rating shall be view from the side window to verify the setting. All strobes shall be synchronization to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules. The strobes shall mount to one-gang electrical box. Shall be GE-EST model Genesis Series devices, or approved equal by Notifier and Simplex.
5. The device shall have plastic protective cover for during installation.
6. The actual candela setting on the visual shall be marked on the appliance.
7. Notification Appliance - Horn

8. Provide low profile wall mount horns at the locations shown on the drawings. The horn shall provide a 95 dBA sound output at 10 ft. when measured in reverberation room per UL-464. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. The horn shall mount in a 1-gang box. Shall be GE-EST model Genesis Series device, or approved equal by Notifier and Simplex.
9. The device shall have plastic protective cover during installation.
10. Notification Appliance – Horn/Strobe
11. Provide low profile wall mount horn/strobes at the locations shown on the drawings. The horn/strobe shall provide an audible output of 95 dBA at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide synchronized flash outputs. The strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd & 110cd (field adjustable) devices. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. Low profile horn/strobes shall mount to one-gang box. Shall be GE-EST model Genesis Series device, or approved equal by Notifier and Simplex.
12. The device shall have plastic protective cover during installation.

Q. Inspection Bar Codes

1. Inspection bar codes shall be installed on all initiating devices, annunciators, control panels and power supplies.
2. Inspection bar codes used by the system must utilize Code 3 of 9 or other approved format, and contain a minimum of eight (8) digits that comprise a unique serial identifier within the Web-based Reporting System. There shall be no duplication of serial numbers. Serial number shall be printed below the bar code for identification purposes.
3. Inspection bar codes shall be limited in size to no more than 2" (5cm) in width, and 3/8" (2 cm), in height and shall include a Mylar[®] or other protective coating to protect the bar code from fading due to sunlight or exposure.
4. Inspection bar codes shall be installed on each device in such a manner as to require that scanning of the bar code take place no further than 12" from the device during inspection.

R. Wire and Cable

1. Signaling Line Circuits – Annunciator Data: Twisted pair, not less than No. 18Awg or as recommended by the manufacturer.

2. Signaling Line Circuits – Intelligent Loop: Twisted pair, not less than No. 18Awg or as recommended by the manufacturer.
3. Circuit Integrity Cable: Provide as required to meet NFPA or Local Code requirements.
4. CI Cable shall meet National Electrical Code, power limited fire alarm service.
5. Existing wiring may be reused as long as it is in good shape, free of electrical noise, and meets the requirements of National Electrical Code and local AHJ.
6. Notification Appliance Circuits –
7. Horn and Visual. 12AWG XHHW or as recommended by the manufacturer.

III. CONSTRUCTION REQUIREMENTS

A. Equipment Installation

1. Comply with NFPA72 for installation of fire-alarm equipment.
2. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.
3. Smoke- or Heat-Detector Spacing:
 - a. Comply with NFPA72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - b. Comply with NFPA72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - c. Smooth ceiling spacing shall not exceed 30 feet.
 - d. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 - e. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
4. Duct Smoke Detectors: Comply with NFPA72 and NFPA90A. Install sampling tubes so they extend the full width of duct.

5. Single-Station Smoke Detectors: Where more than one smoke alarm is installed, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
6. Notification Appliance Devices: Install between 80 and 96 inches on the wall.
7. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.
8. Annunciator: Install with top of panel not more than 56 inches above the finished floor.

B. Connections

1. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
2. Alarm-initiating connection to activate emergency lighting control.
3. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.

C. Identification

1. Identify system components, wiring, cabling, and terminals.
2. Install framed instructions in a location visible from fire-alarm control unit.
3. All initiating devices shall have bar code label installed visibly on the device. This bar code shall be used for digital inspection of the fire alarm system using Building Reports.Com.

D. Grounding

1. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

E. Field Quality Control

1. Field tests shall be witnessed by the Engineer and authorities having jurisdiction.

2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
3. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. Visual Inspection: Conduct visual inspection prior to testing.
 - 1) Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - 2) Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72; retain the "Initial/Reacceptance" column and list only the installed components.
 - b. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72.
 - c. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - d. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - e. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - f. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72.

5. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
6. Fire-alarm system will be considered defective if it does not pass tests and inspections.
7. Prepare test and inspection reports.
8. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
9. Annual Test and Inspection: During the warranty period, each year test fire-alarm system complying with visual and testing inspection requirements in NFPA72. Use forms developed for initial tests and inspections.
10. Detector Sensitivity Testing: During the warranty period, each year the contractor is to perform detector sensitivity testing and provide report to the Chicago Department of Transportation. Unless, the system is UL Listed to perform automatic sensitivity testing without any manual intervention and should detector fall outside of sensitivity window, the system will automatically indicated a devices trouble. A copy of UL letter is to be provided as proof of system operation

F. Demonstration

1. Engage a factory-authorized service representative to train Chicago Department of Transportation maintenance personnel to adjust, operate, and maintain fire-alarm system.

IV. METHOD OF MEASUREMENT.

- A. The various electrical items will not be measured. Payment will be made based on the amount bid for the item in the proposal.

V. BASIS OF PAYMENT.

- A. Payment will be made under:

Pay Item

Pay Unit

ADDRESSABLE FIRE ALARM SYSTEM

LUMP SUM

- B. Payment for the Fire Alarm System items shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

SUBMARINE CABLES

I. DESCRIPTION

- A. Under this item, the Contractor shall furnish all materials, labor, plant, and equipment for carrying the power, control, lighting, and other circuits across the navigable channels, where indicated on the Plans, in the submarine cables.
- B. The work shall include:
- Furnishing and installing new submarine cables under each channel, conduits in the rest piers, armor clamps, bell ends, cable terminators, brackets, supports, and other equipment required to complete the on-site services of the cable manufacturer's representative.
 - The complete rehabilitation of the existing west and east side submarine terminal cabinets including new terminal blocks, panels, fittings, and mounting hardware.
- The Contractor shall warrant the in-service performance of the submarine cables for one year following final project acceptance.
 - The work shall include installing submarine cables under each channel, and other equipment required to complete the installation as well as the on-site services of the cable manufacturer's representative and Inspection Diver. The underwater cable work in the river bottom shall be done under this item.
 - Contractor shall refer to other pay items for additional preparation work for the cable laying procedure.

II. MATERIALS

A. Conformance

8. All electrical equipment and its installation shall conform to the requirements of the latest revision of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials, except as may be otherwise provided herein.
9. Materials and construction shall conform to the requirements of the current National Electrical Code and United States Coast Guard, and to any applicable local rules and ordinances. The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

B. Equipment and Material Provisions

1. All equipment and materials shall be new. All equipment, materials, and workmanship shall be first-class in every particular and shall be

manufactured and erected to the satisfaction of the Engineer. The Contractor shall warrant the in-service working of the electrical installations for one year or the manufacturer's warranty period, whichever is greater, following project acceptance by The Department. If the Contractor has any objection to any feature of the electrical equipment as designed and laid out, he must state his objection at once in writing to the Engineer prior to fabrication and/or installation, otherwise his objection will be ignored if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus. Changes shall be made at the discretion of the Engineer.

2. Electrical equipment and apparatus shall have waterproof and corrosion-resisting markings with the name of the manufacturer, the rating or capacity of the equipment or apparatus, etc.
3. All metal parts of the installation, except structural steel, shall be of corrosion-resisting material, such as bronze or stainless steel. Malleable iron or steel with a hot-dip galvanized finish or stainless steel shall be used where specified herein. Structural steel shall conform to the requirements given under "Structural Steel".
4. All mounting hardware and all wire and cable terminals shall be vibration proof.
5. If any changes from the Plans or these Specifications are deemed necessary by the Contractor, details of such changes and the reasons therefore shall be submitted for approval as soon as practicable, but before the first submittal. No such changes shall be made nor work started without approval of the Engineer.
6. Material requirements for specific apparatus, equipment, and materials are found in the articles under "Construction Requirements" in this item.

C. Electrical Items Covered In Other Sections

1. Section "Bridge Electrical and Controls Equipment"
2. Section "Integrated Bridge Control System"
3. **Section "Fiber Optic Cable, Single Mode".**

D. Submittals

1. The Contractor shall submit to the Engineer seven (7) certified copies of all the factory test data for approval before accepting shipment of cable from the manufacturer. The test data shall include, in tabulated form, a description of the material undergoing test, a description of each test performed, the measured or observed results, and the value and limits required by the ICEA/NEMA Standard for acceptance.
2. The Contractor shall submit to the Engineer seven (7) copies of a statement certifying that the cable delivered for use under this Contract

has passed the required factory inspections and tests and complies with all the requirements, including materials and construction, of the Standards and Specifications in the Contract.

3. Typical published test data providing the physical and electrical characteristics of the proposed cable-insulating compound.
4. Working Drawings
 - a. The Contractor shall prepare and submit to the Engineer for approval the following working drawings executed in accordance with the provisions of the Contract:
 - b. A drawing to scale showing the location, depth, and length of cables, together with the proposed method of installing the cables. This drawing shall be submitted and approved prior to placing a cable order with any manufacturer.
 - c. Typical published test data showing physical and electrical characteristics of the proposed cable insulating compound.
 - d. Manufacturer's construction drawings of all submarine cables showing the sizes of conductors, thickness of insulation, makeup of the cable layers, type and size of jackets, armor, jute serving and other components, and the outer diameters of the finished cables.
 - e. Detail drawings showing the construction of the submarine cable terminal boxes and cabinets and all equipment and components mounted therein. Terminal tagging must be shown prior to cable installation.
 - f. Any other drawings, which may, in the opinion of the Engineer, be necessary to show the electrical work.

i. CONSTRUCTION REQUIREMENTS

A. Submarine Cables

1. New submarine cables shall be furnished and installed under the navigation channel. The submarine cables, terminal cabinets, cable supports, armor clamps, bell ends, cable terminators, brackets, and hardware shall be provided as needed for installation, and are included under this item. The terminal cabinets shall be rehabilitated as necessary to remove the existing cables, and terminate the new submarine cables
2. The submarine cable shall be obtained from a manufacturer that is experienced in producing submarine cable. Before cable orders are placed with any manufacturer, the Contractor shall determine the true

length of each cable between the submarine cable terminal cabinets. Splicing or joining of conductors between these points will not be permitted. In addition, the Contractor shall verify the conductor counts of each cable with the vendor of the bridge control system to ensure a minimum of 15% of the specified number of conductors are spare conductors.

3. The Contractor shall be responsible for ascertaining and procuring the correct continuous length of submarine cables, including sufficient excess length to accommodate pulling eyes, adequate slack for submarine cable settling, cable clamping, connections, and for test samples.
4. The Contractor shall be responsible for ascertaining and ordering the correct conductor counts based on his approved working drawings supplied by the control system vendor. In no case, shall the conductor counts be less than those hereinbefore specified.
5. Materials and construction of the submarine cables shall conform to all applicable and referenced standards of NEMA WC70 / ICEA S-95-658, latest revision, UL Standard 44, NFPA 70 / NEC latest revision, and all local codes under jurisdiction.
6. All conductors shall be annealed uncoated copper to meet ASTM B-3, stranded to meet ASTM B-8, class B stranding, and ICEA S-95-658, NEMA WC70.
7. The insulation of each conductor shall be a moisture-resisting, cross-linked polyethylene (XLPE) compound conforming to the requirements of NEMA WC70 / ICEA S-95-658. The insulation meets accelerated water absorption per Electrical Method EM-60. Insulation thickness shall be is minimum 25 mils for conductor size 22 - 16 AWG, 30 mils for conductor size 14 - 9 AWG, 45 mils for conductor size 8 - 2 AWG, 55 mils for conductor size 1 - 4/0 AWG, 65 mils for conductor size 225 - 500 KCMIL and 80 mils for conductor size 525 - 1000 KCMIL, be rated no less than 2000 V for conductor size 12AWG or larger, 600V for conductor size smaller than 12AWG. The insulation shall incorporate non-carbon fillers to inhibit treeing.
8. In each cable, the insulated conductors shall be cabled to a full circular section using non-hygroscopic fillers, where necessary, to fill out the section. Each layer of the conductors shall be covered with a single serving of moisture-resistant binder tape, lay length and directions conforming to ICEA S-95-658, NEMA WC70.
9. Inner jacket shall be weather and UV-resistant high density polyethylene (HDPE) per ICEA S-95-658, NEMA WC70. Jacket thickness varies per cable diameter; and shall be as shown on Contract Plans.

10. Submarine cable number of conductors, layer and jacket thickness and material shall be as shown on the Contract Plans.
11. Conductors in each layer shall be identified by coloring or marking the outer surface of the insulation. Over the cabled conductors, there shall be applied one layer of binder tape followed by a homogeneous synthetic sheath. Over the sheath, there shall be applied cable armor consisting of a single layer of galvanized steel wire, each wire covered with a layer of polyethylene as per ICEA S-95-658, NEMA WC70. A high-density polyethylene (HDPE) jacket shall be placed over the armor. The HDPE jacket shall be sunlight and weather resistant. Any variations in cable construction or materials from these specifications and shown Contract Plans cross-sectional details shall be submitted to the Engineer for review and approval.
12. Approved moisture-resistant filler material suitable for submarine cable application shall be used in the interstices between and over the insulated conductors to give the complete cable a circular cross-section.
13. Binder tape of approved, suitable, flame-resistant, and moisture-resistant fabric material with a thickness not less than 10 mils shall be applied over the multi conductor/filler assembly and overlapped not less than 10 percent of its width between turns.

B. Cabinets and Hardware

1. Each submarine cable shall be supported by custom clamps and supporting hardware. The clamp assembly shall be fabricated of hot dipped galvanized steel, and made specifically for this use. All hardware shall be of stainless steel conforming to the requirements of ASTM Designation A276, Type 316. Bolt heads and nuts shall be hexagonal, and shall be provided with medium series lock washers.
2. The jacketed core of each submarine cable entering terminal cabinets shall be secured at the entrance wall by a watertight, stainless steel or bronze cable entrance sealing bushing. No box shall be drilled for more conduits or cables than actually enter it.
3. The terminal cabinets shall provide termination for the submarine cables. The cabinet shall be of adequate size to mount all terminal blocks and ample space between blocks for routing of the wires. The power wiring shall be routed separately from control wiring inside each cabinet.
4. The submarine cable terminal cabinet shall include the following:
 1. Enclosure panels shall be fabricated from No. 10 gauge Type 316 stainless steel reinforced by steel angles. In the front cover, there shall be installed two framed overlapping doors hung on continuous stainless steel piano hinges and which shall provide access to the equipment inside.

2. The doors shall be provided with rubber gaskets, which shall prevent water from entering the cabinets. Reinforcing plates shall be welded to the walls where conduits and cables enter the cabinets. The cabinet shall be provided with drain fittings. The submarine cable terminal cabinet enclosures shall be constructed to type NEMA 4X standards.
 3. Terminal blocks shall be provided in each terminal cabinet for the connection of all conductors in the submarine cables. Sufficient terminals shall be provided for termination of all spare conductors and other conductors to be terminated inside the cabinet. All terminal blocks and boards shall be mounted on structural steel brackets in such a manner as to permit routing the cables behind the blocks. Terminal blocks shall be one-piece blocks suitable for use in highly corrosive atmospheres.
 4. Conduits or sleeves for passage of the submarine cables shall be PVC coated rigid steel conduits, hot-dip galvanized.
- a. The Contractor shall carefully review and field survey each terminal cabinet prior to submitting detailed plans and schedules for the replacement work approval to the Engineer. The Contractor shall perform terminal cabinet replacement work only after the Engineer's review and approval of the cabinet and conduit layout work drawings.

C. Construction Scheduling

1. The disconnecting and removal of existing cables, the replacement of other existing equipment such as existing terminal cabinets, the installation of new apparatus and equipment and the connections of all existing and new apparatus shall be coordinated with the structural, architectural, and mechanical work under this contract and shall be done in conformance with the requirements governing the sequencing and scheduling of construction as shown on the Plans and specified herein.

D. Connections to Existing Facilities

1. The Contractor shall make all connections required between the new equipment and the existing circuits and apparatus to provide for proper operation of the span and its auxiliary equipment, in accordance with the requirements specified herein.

E. Cutting, Patching and Miscellaneous

1. The contractor shall perform all necessary drilling, cutting, and patching required to install his work. All cutting of concrete, structural steel, sidewalks, floor slabs, walls, and other portions shall be done by skilled personnel. All conduits and pipe sleeves shall be properly grouted in the mortar.

2. After completion of the work, the Contractor shall repair all damage caused by his installation or removal of items and shall finish the job in a workmanlike manner satisfactory to the Engineer. Holes in the walls, ceiling, or floor shall be patched and finished to match the existing surfaces. Painted surfaces shall be repainted after being repaired. Any damage to windows, window framing, sash, sills, frames or any other architectural trim shall be repaired by Contractor at his own expense.

F. Material Installation/Entry Clearance

1. To facilitate installation of the electrical and electrical related assemblies, the Contractor shall review all drawings to ensure that adequate installation space is available. Review of space installation shall be provided prior to manufacture or purchase. Units too large to fit through or into available space shall require the Contractor to enlarge the opening, relocate or re-package the internal equipment at no additional expense to The Department.
2. The Contractor shall arrange, furnish, and install hoisting equipment to facilitate installation and removal of various items. The Contractor shall ensure that the hoisting device has sufficient capacity to raise and lower the loads.

G. Equipment Labels

1. All electrical devices, disconnect switches and cabinet equipment shall have a label affixed to each unit. The label shall be similar in construction to the aforementioned nameplates. Each label shall be of suitable size and letter characteristics. Text shall indicate name/function of each item. Disconnect switches shall provide a label indicating the voltage within. Labels shall be securely attached using stainless steel screws. The Contractor shall submit to the Engineer for review, all signs, with sizes, location and text.

H. Installation

1. Where the cables cross the navigable channel, they shall be laid at the bottom of the channel as shown on the Plans. The cables shall be laid without twists or loops. No cable shall be permitted to cross each other. The route of the cables may have to be altered to avoid unforeseen obstructions.
2. The method of submarine cable installation with a point-to-point cable routing shall be in a manner as to minimize environmental impact and any potential hazard for the marine traffic or bridge structures.
3. The cable laying shall be performed without damaging the bridge structure, fenders, pile clusters, or any existing substructure and as directed by the Engineer.

4. During the installation of the cables, the Contractor shall arrange to have at the site a representative of the cable manufacturer. This representative shall be experienced in submarine cable handling and installation procedures, and he shall advise the Contractor and the Engineer in these matters.
5. The cables shall be allowed to settle for a period of a minimum of 48 hours or as required by the submarine cable installer, after the last cable has been placed, before any rigid connections or attachments are made. The submarine cables shall be of sufficient length to allow for slack in settlement and to allow for making permanent connections.
6. The Contractor shall provide proper equipment for handling the submarine cables including lifting or lowering the submarine cables at the piers. He shall exercise proper care so as not to over stress, score, or cut the conductors, insulation, outer jacket or armor, or otherwise damage the cable.
7. The Contractor shall determine the proper type of lifting or lowering device for the cables, subject to approval by the Engineer, and shall include considerations for the quantity and size of conductors in the submarine cable and distances involved.
8. The underwater cable laying installation specific surveying and cable routing shall be performed by a qualified Contractor with minimum three successful similar installations performed under the IDOT jurisdiction.

I. Arrangement and Connections of Cables

1. Slack shall be provided for the submarine cables and their conductors in the terminal cabinets.
2. After the submarine cables have been installed in place and are awaiting termination, the ends of the conductors shall be test-capped and the ends of the submarine cables sealed to prevent entry of moisture.
3. Conductors inside the terminal cabinets shall be neatly formed into cables and laced with approved cable ties, with the individual conductors leaving the cable at their respective terminal points. These conductors shall be looped to allow not less than 3 inches of free conductor when disconnected.
4. Both ends of every single length of conductor in the submarine cables shall be permanently and clearly tagged in accordance with the same numbers or designations appearing on the wiring diagrams provided under the item "Electrical Work." For conductors of Size No. 10 AWG and smaller, all wire ends shall be provided with compression-type, ring-tongue wire connectors suitable for connection to screw-type terminals.

5. Terminal blocks shall be marked to show the wire number and designation of each conductor connected thereto. The markings shall be placed labels made of a material that will not be affected by discoloration with age or by moisture. The labels shall be given two coats of clear lacquer after the markings are placed thereon.

J. Shop Testing

1. All cable at the factory shall be tested in accordance with the latest test methods of ICEA/NEMA Standards for the types of cable and insulating materials specified and shall meet or exceed the minimum requirements and criteria for acceptance as set forth therein.
2. Prior to assembly and fabrication of the submarine cables, the individual insulated conductors to be incorporated in the cables shall be tested to demonstrate the quality of the production run. The conductors and insulating compounds shall meet the minimum physical and electrical requirements set forth in ICEA S-95-658, NEMA WC70, UL Standard 44 and referenced standards. The test reports shall be submitted for approval prior to shipping any cable.
3. After each multi conductor cable is completely assembled and armored, it shall be subjected to tests for insulation resistance and high voltage. High-voltage tests shall be made at the same voltage used on the individual wires, and the insulation resistance shall not be less than 80 percent of the original values for the individual wires.

K. Field Acceptance Testing

1. The Contractor shall arrange for and provide all the necessary field tests and inspections including but not limited to insulation resistance and continuity tests, as directed by the Engineer, to demonstrate that the entire submarine cable system is in proper working order and in accordance with the Plans and Specifications.
2. Should the tests and inspections show that any part of the submarine cable system, in the judgment of the Engineer, is defective or functions improperly, such adjustments, touch-ups and/or replacements shall be made by the Contractor as to make the installation satisfactory to the Engineer and at no extra cost.

IV. METHOD OF MEASUREMENT

- A. MEASUREMENT FOR THE PAY ITEM "SUBMARINE CABLES" SHALL BE MADE ON A LUMP SUM BASIS.

V. BASIS OF PAYMENT

- A. Payment will be made under:

Pay Item

Pay Unit

SUBMARINE CABLES

Lump Sum

VECTOR-CONTROLLED MOTOR DRIVES

I. DESCRIPTION

- A. Provide and install 4 motor control systems, each consisting of two (2) 75 hp ac, 4-quadrant, dynamic braking vector-controlled pulse width modulated motor drives, isolation transformers and sequence controllers to interface between the motor drives and the bridge control system. The drive systems shall be suitable for the control of the 75 hp vector duty rated induction motors specified. The drive systems shall be of the same manufacturer and the enclosures shall be of the same product line.
- B. The intent and purpose of this specification is to define the minimum design, material, and construction requirements of the main span drive motors and controls which are not otherwise defined on the Contract Plan drawings. Further, it is the intent of this specification to define the testing, installation, and adjustments necessary to put into approved working order.
- C. Any device, material, labor, or effort not specified by name in the contract drawings or herein, yet required to complete or make the drives operate as specified, and shall be furnished by the Contractor at no extra cost to the Contracting Agency.
- D. References: Unless otherwise stated, the reference standard shall be that which is current as of the date issuance of the specifications. Reference may be made to standards either by full name or by the letter designations as follows:
 - 1. ANSI - American National Standards Institute
 - 2. AWG - American Wire Gauge
 - 3. IEEE - Institute of Electrical and Electronics and Engineers
 - 4. NFPA - National Fire Protection Association
 - 1. NFPA 70 - National Electrical Code (NEC)
 - 5. NEMA - National Electrical Manufacturers Association
 - a. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.
 - b. NEMA ICS 6 - Enclosures for Industrial Control Systems
 - c. NEMA ICS7 - Adjustable Speed Drives

- d. NEMA MG-1 - Motors and Generators, Test Method B.
 - e. NEMA 250 - Enclosures for Electrical Equipment (1000V maximum)
6. UL - Underwriters Laboratories
- UL 508 - Standard for Industrial Control Equipment
- E. Submittals: Submit data for all items as follows:
- 1. Drawings: The Contractor shall furnish installation drawings with information such as weights, lifting instructions, storage instructions, mounting data, ventilation requirements, locations of electrical connections, location and sizes of ground terminations, locations and recommended use of shielded wire where required.
 - 2. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
 - a. Preliminary setting values for all adjustable parameters.
 - b. Internal Wiring diagrams of all cabinets
 - c. Wiring diagrams for field connections.
 - 3. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and over current protective devices, short circuit ratings, dimensions, and enclosure details.
 - 4. Qualifications information required herein below.
 - 5. Test Reports: Submit for approval of the Engineer, field test and inspection procedures and test results.
 - 6. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
 - 7. Manufacturer's Field Reports: Indicate start-up inspection findings. Tabulated setting values for all adjustable parameters.
- F. Operation and Maintenance Data
- 1. Operation Data: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

2. Maintenance Data: Include routine preventive maintenance schedule.
3. Instruction Manuals: The Contractor shall furnish instruction manuals with manufacturer's information and recommendation covering:
 - a. Controller characteristics such as: ratings, conditions for applications and service, control functions, protective functions, and options available or included.
 - b. Safety precautions and procedures before and during installation, starting adjustments, and maintenance.
 - c. External control and power wiring, including grounding.
 - d. Recommendations to optimize immunity to electrical noise.
 - e. Listings of phenomena external to the Controller that can cause malfunctions or dangerous conditions, with suggested corrective actions.
 - f. Troubleshooting procedures with symptom cause-effect and corrective recommendations, based on manufacturer's recommended SRUs (Smallest Replaceable Units).
 - g. Replacement Parts List: Include annotated views to show all component locations, nomenclature and part numbers.
- G. Nameplates: Each piece of equipment and apparatus shall have a permanent, corrosion-resistant, metal nameplate on which is stamped the name of the manufacturer, the catalog or model number, and the ratings of the equipment or apparatus.
- H. Delivery, Storage, and Handling
 1. Deliver shipping sections individually wrapped in factory fabricated fiberboard type containers and with lifting angles on each structure.
 2. Handle distribution and control equipment carefully to prevent internal component damage, and denting or scoring of enclosure finish. Do not install damaged equipment.
 3. Store equipment in a clean dry space. Protect units from dirt, fumes, water, construction debris and traffic.
- I. Qualifications: The manufacturer shall be specialized in the manufacturing of the Materials specified in this section and possess a minimum of 5 years documented successful experience in control of movable bridges. The manufacturer shall have service facilities within 100 miles of Project.

II. MATERIALS

None Specified

III. CONSTRUCTION REQUIREMENTS

A. General

1. The individual bascule leaves will have 2 main drive motors. The main drive motors are new. Each motor shall be provided with a dedicated drive. The 2 drives of each pair shall be integrated into a drive system with logic control to perform the opening and closing operations described in this specification.
2. All electrical and electronic components, including logic control, comprising these drive systems shall be supplied by a single manufacturer and shall bear the same brand name and trade mark unless specifically stated other wise.

B. Motor Drive

1. The motor drive shall be a reversing, crane rated, 4 quadrant with dynamic braking, vector-controlled pulse width modulated PWM controller for a vector duty rated induction motor.
2. The input voltage shall be 480 +/-10 percent V ac, 3-phase, 60 Hz output rating shall be 75 hp, 460V, 6 – 60 Hz. The drive shall be provided with line side circuit breakers, current limiting fuses and contactors with overload protection on the outputs.
3. Drives shall be digitally controlled. Programming shall be by means of a keypad/display on the enclosure door.
4. Speed regulation shall be to capable of holding speed within 0.01 percent of set speed using encoder feed back. However, actual settings shall be + 5 percent initially and shall be adjusted in the field for optimum performance of the bridge machinery. The following performance parameters shall be programmable:
 - a. Speed- A minimum of 2 preset speeds forward and 2 preset speeds reverse for normal operation plus automatic adjustment for high torque conditions.
 - b. Acceleration and Deceleration - Rates shall be independent of each other. Adjustment range shall be 0.1 - 60 seconds or more.
 - c. Rate of Change- The speed control response time shall be tunable to allow speed corrections without "jerking" the machinery.

- d. Torque- Programmable to provide 150 percent of rated torque for 1 minute, 180 percent upper limit, and clamp at 20 percent (adjustable from 5 to 25 percent) when leaf is seating and full closed limit switch is open. Programmable to hold 20 percent until the motor brakes are set, then automatically go to zero.
 - e. Torque Proving - The drive shall be programmable to provide a contact closure output to release the motor brakes only when the motor is producing torque. The torque setting shall be programmable from 0 to 50 percent.
 - f. The drives shall be provided with automatic testing and tuning software.
- 5. Drives shall be programmable to operate with an encoder feedback signal and provide A and B channel quadrature pulses plus a Z channel marker pulse.
 - 6. The drives will normally be operated individually but shall be capable of high-speed digital communication with the second drive in a master to master protocol should it become necessary to operate 2 drives together.
 - 7. Dry contact relay outputs shall be provided for status indication of READY/RUNNING, TROUBLE and SHUTDOWN (See also alarms from logic controller).
 - 8. Transmitters: Each drive shall be equipped with a transmitter to measure motor amps, motor volts, and motor rpms. The transmitter shall provide a 4-20mA output signal, which is proportional to input from 0 to the full rated input of the drive plus 10 percent.
 - 9. The drives shall be provided with separate enclosures. Enclosures shall be free standing NEMA 12 cabinets. Nominal dimensions shall be 90 inches high, 36 inches wide and 24 inches deep. Each enclosure shall include an external operating handle for the drive circuit breaker. The handle shall be padlockable in the off position and shall include a mechanical interlock to prevent the enclosure door from being opened with the breaker in the on position.
 - 10. Each enclosure shall be provided with a filtered, forced air cooling system sized per the manufacturer's requirements for the equipment. The cooling system failure alarm shall be provided.
 - 11. The Contractor shall be responsible for all final fitting of the components provided by the Contractor.
- C. Line and Load Reactors: Each drive shall be provided with line and load reactors, provided and sized as required by the motor drive manufacturer. The line and load reactors shall be specifically designed for electronic motor drive service.

Transformer enclosures shall be ventilated and floor-mounted. Coils shall be copper; insulation shall be suitable for 150° C rise.

D. Logic Control

1. A control system shall be provided as an interface between the Bridge Control System and each pair of Motor Drives.
2. The manufacturer shall provide standard logic control components. There shall be no prototypic or undocumented assemblies, firmware, or software, allowed.
3. The control panel shall interface with the bridge control system by means of dry contact inputs and outputs.
 - a. Inputs
 - 1) Run - normally open contact; close to run.
 - 2) Open (Forward) normally open contact; close to operate.
 - 3) Close (Reverse) normally open contact; close to operate.
 - 4) Emergency Stop - normally closed contact; open for emergency stop.
 - 5) Limit Switch - full closed position: normally closed contact; open to stop when leaf is fully closed.
 - 6) Limit Switch - nearly closed position: normally closed contact; open to slow down.
 - 7) Limit Switch - nearly open position: normally closed contact; open to slowdown.
 - 8) Limit Switch - full open position: normally closed contact; open to stop when leaf is fully open.
 - 9) Limit Switch - full seated position: normally closed contact; open to stop when leaf is fully open.
 - 10) Motor Brake 1 Set.
 - 11) Motor Brake 1 Released.
 - 12) Motor Brake 1 Manually Released.
 - 13) Motor Brake 2 Set.

- 14) Motor Brake 2 Released.
 - 15) Motor Brake 2 Manually Released.
- b. Outputs
- 1) Drive System Running, normally open, closed to run.
 - 2) Drive System Trouble, normally closed, open when trouble.
 - 3) Drive System Shutdown, normally closed, open to shutdown.
 - 4) Release Motor Brake 1, normally open, close to release.
 - 5) Release Motor Brake 2, normally open, close to release.
 - 6) Drive System Control OFF, normally closed, open to turn off.
4. Manual Controls: Manual Controls shall be provided on the cabinet door. Manual control shall include:
- a. OPEN – AUTOMATIC – CLOSE: Momentary position selector switch spring return to center position.
 - b. EMERGENCY STOP - Maintained position mushroom head operator. Push to stop, turn and pull to reset.
5. Operation Requirements
- a. All of the movable leaf motion shall be controlled ultimately by the drive logic controller in response to discrete commands from the Integrated Bridge Control System and feed back from the encoder and limit switches. That is, the Integrated Bridge Control System provides contact closures for RUN, OPEN, and CLOSE, and contact openings for EMERGENCY STOP. The position limit switches, connected directly to the logic controller provide FULLY CLOSED, NEARLY CLOSED, NEARLY OPEN and FULLY OPEN provide contact openings for slow down and stop. The drive assembly logic control detects the command signal as well as the span position limit switches and in turn provides control inputs to the active drive. The drive on-board control controls acceleration, deceleration, direction, and speed of the motor. In addition, the logic controller controls and monitors the operation of the motor brakes.
 - b. For complete description of the bridge operation overall see Integrated Bridge Control System.

c. Bridge Control Considerations

- 1) The bascule leaf machinery is two open gear train. The feed back loop must be tunable to allow for any gear lash situations.
- 2) The balance of the bascule leaf is such that the center of gravity passes over the trunnion. This causes the load to reverse from being driven to overhauling. This reversal combined with the machinery windup creates a condition in which the final drive pinion loses contact with the rack tooth and a moment later contact is remade on the opposite side of the pinion and rack teeth. The drive control must be capable of maintaining constant motor speed when the load drops off and smoothly ramping up torque, in the proper direction, when the load returns.
- 3) The balance of the bridge varies with ice and snow loading. The dynamic load of the machinery may also vary with wind conditions. The drive must be capable of responding to these variations without inducing oscillations into the system.

6. Drive Operating Sequence

a. Normal Operation

- 1) When the RUN command input is closed, the drive shall energize and go to a state of readiness.
- 2) When the drive is ready, the logic controller shall provide a contact closure output to indicate DRIVE RUNNING.
- 3) When both RUN and OPEN request input are closed, (regardless of the state of the NEARLY CLOSED and FULL CLOSED limit switches), the drive assembly controller shall energize and provide torque (adjustable to 100 percent) at zero speed before it energizes both motor brake starters. Upon sensing the motor brakes released, the drive shall accelerate the main motor per the acceleration ramp setting to full operating speed.
- 4) If the OPEN request input should open during operation the drive shall decelerate the motor, according to the deceleration ramp setting, to a stop, hold the leaf at zero speed and de-energize the motor brakes.

- 5) If the drive is running, (both RUN and OPEN request inputs are closed) when the NEARLY OPEN limit switch opens the motor shall be decelerated per the ramp setting to creep speed (10 percent of full operating speed).
- 6) If the OPEN request input should open while the drive is running, the drive shall decelerate and stop the motor as in Step d. When the RUN and OPEN request inputs are reclosed, if the NEARLY OPEN limit switch contacts are open, the drive shall accelerate the motor directly to creep speed.
- 7) If the RUN and OPEN request inputs are closed, the NEARLY OPEN limit switch is closed, and the motor is stopped, the drive shall accelerate the motor, in the forward direction to full speed. If the motor is running in reverse when the request inputs change to OPEN, and the NEARLY OPEN limit switch is closed, the drive shall decelerated the motor, per the ramp setting, to a complete stop then accelerate the motor to forward full operating speed.
- 8) If the drive is running (both RUN, OPEN, request inputs are closed), and the NEARLY OPEN is open, when the FULLY OPEN limit switch contacts open, the drive assembly controller shall de-energize the motor brake releases and de-energizes the motor.
- 9) When both RUN and CLOSE request input are closed, (regardless of the state of the NEARLY OPEN and FULL OPEN limit switches), the drive assembly controller shall energize and provide torque to hold the bridge at zero speed, then energize both motor brake starters. Upon sensing the motor brakes released the drive shall accelerate the main motor per the acceleration ramp setting to reverse full operating speed.
- 10) If the CLOSE request input should open during operation the drive shall decelerate the motor, according to the deceleration ramp setting, to a stop and de-energizes the motor brake release.
- 11) If the drive is running, (both RUN and CLOSE request inputs are closed) when the NEARLY CLOSED limit switch opens, the motor shall be decelerated per the ramp setting to reverse creep speed.
- 12) If the CLOSE request input should open while the drive is running, the drive shall decelerate and stop the motor as in

Step d. When the RUN and CLOSE request inputs are closed, and the NEARLY CLOSED limit switch contacts are open, the drive shall accelerate the motor directly to reverse creep speed.

- 13) If the RUN and CLOSE request inputs are closed, the NEARLY CLOSED limit switch is closed, and the motor is stopped, the drive shall accelerate the motor to reverse full speed. If the motor is running in the forward direction when the request inputs change to CLOSE, and the NEARLY CLOSED limit switch is closed, the drive shall decelerated the motor, per the ramp setting, to a complete stop then accelerate the motor to reverse full operating speed.
 - 14) As the bridge is landing, (both RUN, and CLOSE inputs are closed and the NEARLY CLOSED limit switch is open), when the FULLY CLOSED limit switch opens the drive assembly controller shall instantaneously de-energize motor brake starters while maintaining 20 percent of motor torque. After a 1 second delay, the motor shall be de-energized.
 - 15) When the drive is de-energized, with the leaf in the fully closed position, the controls shall alternate to start the other motor on the next operation.
- b. Emergency Stop: If the RUN input should open during operation, the main motor and brakes shall be de-energized. THE MOTOR SHALL COAST TO A STOP. (The brakes will be adjusted to stop the bridge in 5 to 6 seconds (see Mechanical sections for details).
- c. Abnormal Conditions
- 1) If 1 motor brake manually released, the drive shall not accelerate the bridge over 10 percent of speed. If more than 1 brake is manually released the drive shall not operate.
 - 2) If 1 motor brake is manually released during operation, the drive shall decelerate the motor to 10 percent of speed. If more than 1 brake is manually released the drive shall decelerate the bridge to a stop and de-energizes the motor brake release circuits.
 - 3) If the drive energizes the output and 1 or more brakes do not release within 1 second, the drive shall shut down.

- 4) If the motor current exceeds 150 percent of running current for more than 10 seconds the drive shall automatically ramp the speed down until motor current is 100 percent then ramp speed up to no more than 50 percent of speed. Speed shall reset to normal upon request to operate in the opposite direction.
- 5) Each motor shall be fitted with an encoder. Upon sensing loss of encoder signal, the affected drive shall be shutdown and the alternate drive shall start.

d. Alarm Output

- 1) TROUBLE and SHUTDOWN alarms shall be indicated by a light on the enclosure door. The alarm conditions shall be indicated by an alphanumeric display on the door or by calling up an alarm register on a programming terminal. All alarms shall be latched on until manually cleared. A normally closed auxiliary contact shall be provided for a remote indicating light on the control desk.
- 2) The drive assembly controls indicate DRIVE TROUBLE if:
 - Either drive internal trouble exists.
 - Drive assembly is de-energized.
- 3) The drive assembly shall shut down the drive, indicate DRIVE SHUTDOWN on the enclosure door, and shall close the DRIVE TROUBLE contact if either drive has operational or electrical line conditions out of tolerance, reverse phase rotation, line synch loss, or mechanical failures such as encoder loss, over speed, etc.

E. Shop Testing

1. Prior to shipment, the complete drive assemblies shall be functionally tested to assure completeness and correct operation. The Contractor will provide a test plan and test procedure for approval 30 days prior to start of shop test. Shop tests shall include a dynamometer testing, using the actual drive motors. As a minimum requirement, the motor tests shall demonstrate the motors and drives are capable of operating at the manufacturers' nameplate ratings, factory-furnished motor curves for torque and speed, and as required by the Plans and Special Provisions. The tests shall demonstrate that the drives are capable of providing acceleration torque at 150 percent overload for 1 minute. The dynamometer testing shall also simulate a 150 percent overhauling load, which the drive shall decelerate to a stop.

2. The functional testing shall be witnessed by the Engineer or designated representative. A test results report shall be submitted to the Engineer for review and approval. The report shall outline the test procedure and provided motor speed and torque curves. The Contractor shall provide 14 calendar days prior notice to the Engineer for scheduling purposes.
 3. Upon completion of the factory testing and the approval by the Engineer, the Contractor shall ship the drives to the bridge control system vendor's shop for testing as an integrated system.
- F. Installation Requirements: The motors and controllers shall be installed per the manufacturer's recommendations. The Contractor shall be responsible for a complete installation.
- G. Field Set-Up
1. The Contractor shall arrange to have the manufacturer's field engineer at the site for pre-start up inspection, start up, and final adjustment of all of the equipment in this specification item. A minimum of 2 startup activities will be required, 1 for each side of the bridge. The Contractor shall be responsible all of the costs associated with having this person on site.
 2. The Contractor shall touch up scratched or marred surfaces to match original finish.
- H. Field Testing:
- Demonstrate operation of controllers including simulation of all normal as well as failure modes.
 - The drive machinery shall smoothly accelerate the bascule, maintain control of the leaf during load reversal, smoothly decelerate the leaf to creep and stop.
- I. Documentation: The Contractor shall supply test results to confirm that the Controller has been tested to substantiate designs according to applicable ANSI and NEMA standards. The tests shall verify not only the performance of the unit and integrated assembly, but also the suitability of the enclosure venting and rigidity. In addition, the unit shall be factory tested in accordance with ANSI standards.

IV. METHOD OF MEASUREMENT

- A. PAY ITEM "VECTOR-CONTROLLED MOTOR DRIVES" SHALL BE MEASURED ON PER EACH UNIT BASIS.

BASIS OF PAYMENT

- A. Payment will be made under:

Pay Item

Pay Unit

"VECTOR-CONTROLLED MOTOR DRIVES"

EACH

ACCEPTANCE TESTING

- I. Description.
 - A. The work shall consist of testing and placing in proper operating condition, acceptable to IDOT and the Engineer, the complete rehabilitated bridge electrical peripheral systems.
 - B. It is the intent and purpose of these Specifications to cover and include all apparatus, appliances, material, plant and labor necessary to properly install, wire connect, equip, test, adjust, and put in approved working order the respective portions of the work herein specified.
 - C. Training for bridge operators, maintenance staff and others shall be provided. Training shall include on-site as well as off-site locations. Topics shall include AC Drive Control, PLC installation, programming, hardware, software and associated items, closed circuit TV system, barrier gates, warning gates, packaged emergency engine generator, brake operation and maintenance, encoders, and limit switch settings. Topics on fiber optics installation, connection and testing shall also be included.
- II. Materials and Equipment.
 - A. Conformance
 1. All equipment and its installation shall conform to the requirements of the latest revision of the Standard Specifications of Movable Highway Bridges of the American Association of State Highway and Transportation Officials, except as may be otherwise provided herein.
 2. Materials and construction shall conform to the requirements of the current National Electrical Code and to any applicable local rules and ordinances. The Contractor shall obtain required permits and approvals of all Departments of Agencies having jurisdiction.
 - B. Equipment and Material Provisions
 1. All acceptance testing equipment, materials, and workmanship shall be first-class in every aspect of this project and shall be manufactured and erected to the satisfaction of the Engineer, and IDOT. See Specification's special Provisions Section "Bridge electrical and Controls Equipment" for Bridge Control System Vendor Requirements. If the Contractor has any objection to any feature of the equipment as designed and laid out, he must state his objection at once, in writing, to the Engineer and IDOT.

Otherwise, his objection will not be valid as an excuse for operational malfunctioning of the equipment or for defective or broken apparatus.

2. If any changes from the Plans or these Specifications are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted for approval as soon as practicable before construction. No such changes shall be made without approval of the Engineer and IDOT.

III. Construction.

A. Control System Testing

1. The Contractor shall show, by testing using properly calibrated meter, that all control equipment is working within the manufacturer's published limits.
2. The Control System Vendor shall show, step-by-step using the PLC software, that the span operates per specifications and has all interlocks included in the software. The following equipment shall be tested for acceptance according to the specifications:
 - a. Traffic signals.
 - b. Warning gates
 - c. Barrier gates
 - d. Span locks
 - e. All types of limit switches
 - f. Complete PLC system
 - g. Vector-Controlled Motor Drives
 - h. Packaged Engine Generator Set
 - i. Automatic Transfer Switch
 - j. CCTV System
 - k. Fire Alarm System
 - l. Navigational Lights

B. Training

1. Bridge Operator's Training

- a. When the bridge has been completed, tested, and approved by the Engineer, the Contractor shall provide bridge operator training for a period of ten (10) consecutive working days. The Contractor's trainer shall be a skilled person competent to operate the bridge and be completely familiar with the equipment used in the bridge operation and its auxiliaries. He shall also be required to make any adjustments required to the electrical or mechanical equipment within the scope of the contract.
- b. During the 10-day period specified above, the trainer shall be in attendance at the bridge site for a normal working period of 8-hours per day. At other times, during the 10-day period, he shall be available to report to the bridge within 1 hour after verbal notification from the Engineer or his appointed representative.

2. Bridge Operator's Manuals

- a. The Contractor shall provide ten (10) copies of the Bridge Operating Instruction Manual. This manual shall be furnished to the bridge operators one (1) week prior to the training session. The Contractor's trainer shall describe to the bridge operators in detail all salient features contained on the control desk units and how they operate. Operation of each switch and pilot light shall be described. All phases of operations and the bridge operator's responsibility to maintain the bridge in operation shall be described.

3. Training for Maintenance Engineering & Operations Personnel and Movable Bridge Engineering (Design) Personnel

- a. Each training session shall be limited to 15 trainees. The training sessions shall included but not be limited to:
 1. Vector-Controlled Motor Drive
 2. Packaged Emergency Engine Generator
 3. PLC
 4. Brakes, Limit Switches, Encoders, and associated devices
 5. Fiber Optics System
 6. Closed Circuit TV System
 7. Addressable Fire Alarm System
 8. Warning Gates

9. Barrier Gates
 10. Mechanical/Machinery Work
4. Training Materials
 - a. Each vendor shall submit the course outline of the topics to be presented at the training sessions. All courses shall be presented by competent instructors and each vendor shall submit the Instructor's qualifications for approval prior to the training session.
 - b. Each training vendor shall supply all necessary training aids, instruction books, test equipment and any additional items to present a complete training course for the allocated period of time and subject matter to be covered for each trainee.
 - c. It shall be the Contractor's responsibility to procure adequate space for the training program. He shall coordinate the training schedule with each vendor and supply any necessary items to properly allow the training vendor to conduct his courses. Supplying of notebooks, paper for trainees, visual aid devices, blackboards, projection equipment shall be the responsibility of the Contractor.

IV. METHOD OF MEASUREMENT

- A. PAY ITEM "ACCEPTANCE TESTING" SHALL BE MEASURED ON A LUMP SUM BASIS

BASIS OF PAYMENT

- A. The lump sum price for the Pay Item "**ACCEPTANCE TESTING**" shall include all items indicated for this specification, unless otherwise noted.

BRIDGE TEMPORARY POWER AND CONTROLS DURING CONSTRUCTION

I. DESCRIPTION

- A. Under this item, the Contractor shall furnish all labor, materials, plant, and equipment; and shall do all work necessary to install, test, place and maintain in satisfactory operating condition at all times, a temporary control and power system for raising and lowering of the westbound (WB) bridge and all other necessary bridge systems until the successful completion and acceptance of all bridge facilities. The westbound (WB) bridge will include the northwest and the northeast bascule leaves, all associated permanent or temporary westbound

(northeast and northwest) barrier gates, warning gates, traffic signals, gongs and other traffic devices, and all temporary power service installations necessary to successfully operate and maintain bridge and marine traffic during the full period of bridge construction.

- B. The Contractor shall be responsible to maintain all temporary bridge systems operational and available at all times as required by the US Coast Guard regulations and by the City of Chicago, and maintain normal marine traffic schedules as established by the City of Chicago without disrupting the land traffic. It is the Contractor's obligation to acquire the current bridge opening schedule (available from the City of Chicago), and prepare, submit and obtain all necessary approvals from the necessary agencies for the temporary operation of the bridge during construction.
- C. Under the rehabilitation plan of the Congress Parkway Bridge, eastbound bridge side will be constructed first, and will not necessarily require a temporary bridge operating control system. The associated work to temporarily disconnect and position the eastbound (EB) side leaves (southeast and southwest) of the bridge in vertical position during construction shall be also included under this item.
- D. During this construction phase the eastbound traffic will be re-routed to the westbound bridge side. This would require that the westbound bridge with two-way traffic (eastbound and westbound) be operational at all times until the construction of the eastbound bridge is complete and it is operational. It is assumed that during this phase permanent power for the bridge will be obtained from ComEd and the eastbound bridge will be operating on permanent power. However, the Contractor shall include under this item any other supplementary provisions and systems necessary to supply power to all existing and temporary bridge systems without interruptions.
- E. Subsequent to the completion of eastbound bridge all traffic (eastbound and westbound) will be re-routed to the eastbound bridge, and then the westbound bridge construction will resume.
- F. Presently the bridge is supplied by two 600V dc power services from CTA on the east and west sides of the bridge for the bridge span and other control operations. An additional 208V ac ComEd power service provides ac power for the operation of traffic gates, barrier gates, center locks, and miscellaneous loads including the house ancillary systems. Existing independently operated main and auxiliary east and west control desks and bridge control systems are located in the east and west control houses. The two east and west systems control the operations of the east and the west leaves and traffic gates and signals independently from the other side except for the center lock and opposite side traffic gates permissive interlocks.
- G. Presently there is a separate tie clutch mechanism normally engaged, that keeps the east and the west adjacent bascule leaves mechanically connected. During the construction of the eastbound bridge, the Contractor will disengage the tie to

keep the eastbound leaves open during construction, and allow the westbound bridge side to be operated as an independent bascule bridge. The clutches will remain disengaged for the duration of the construction of the eastbound as well as the westbound bridges.

- H. The Contractor is advised that the main bridge leaf control systems are going to be disabled once the two tie clutches are opened between the adjacent leaves, and only the auxiliary leaf systems will be able to operate the westbound leaves when the mechanical separation is completed.
- I. Contractor is advised to carefully examine and test the existing bridge main and auxiliary control and power systems in order to determine and propose the temporary bridge systems.
- J. The existing systems' tests shall include the state of operation of the two east and west auxiliary systems with one motor per leaf only, and shall result in a final determination of the temporary bridge power and control requirements during construction, and in the temporary system approved design, construction and installation.
- K. Following the assessment of existing systems, Contractor shall prepare and submit a clear transition plan from the existing east – west systems and bridge operation to the temporary westbound bridge systems (with the eastbound bridge leaves in open position for construction). The plan shall include proposed temporary westbound bridge systems' satisfactory operation based on the combination of northeast and northwest new and existing control systems, power systems, and traffic devices including traffic gates and barrier gates. All existing and other additional necessary operational safety interlocks shall be maintained and implemented to ensure all safety operational standards are followed in accordance with the applicable regulations.
- L. No interruption in bridge service availability for marine and land traffic will be allowed during this or any other transition period without the express approval of IDOT and the Engineer. Any penalties, fees, or other additional work associated with not keeping the bridge available or failing to operate bridge for marine traffic as required by the US Coastguard, City of Chicago, and other authorities under jurisdiction, will be the responsibility of the Contractor.
- M. Contractor shall verify the satisfactory operation of all existing northwest leaf controls including traffic gates, barrier gates, traffic lights, and other control equipment, devices and wiring.
- N. The Contractor shall warrantee the in-service performance of the temporary control system during construction of the eastbound bridge, and to the final completion of the bridge work as necessary.

- O. A comprehensive transition plan schedule together with specific proposed plans and drawings for temporary power and control systems shall be submitted by the Contractor to the Engineer for approval minimum 30 days prior to starting the actual work.
- P. The submitted plans shall include proposals for of the northeast leaf drive systems, temporary control system block and wiring diagrams, equipment locations and catalog cuts, logic programming, wiring and other layouts, prepared and submitted by the Contractor's Engineer minimum 30 days prior to the actual work start date. This information shall be submitted to the Engineer as detailed herein under these and other applicable special provisions.
- Q. The temporary control system shall be furnished and installed by the same Control System Vendor that will furnish and install the new permanent full bridge control system.
- R. Contractor shall refer to item "Bridge Electrical" for removal of existing bridge controls.

II. MATERIALS

A. Conformance

1. ALL ELECTRICAL EQUIPMENT AND ITS INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF THE LATEST REVISION OF THE STANDARD SPECIFICATIONS FOR MOVABLE HIGHWAY BRIDGES OF THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, EXCEPT AS MAY BE OTHERWISE PROVIDED HEREIN.
2. MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT NATIONAL ELECTRICAL CODE (NEC) AND TO ANY APPLICABLE LOCAL RULES AND ORDINANCES. THE CONTRACTOR SHALL OBTAIN ANY REQUIRED PERMITS AND APPROVALS OF ALL DEPARTMENTS OR AGENCIES HAVING JURISDICTION. ALL WORK SHALL BE IN CONFORMANCE WITH THE REQUIREMENTS OF THE UNITED STATES COAST GUARD AND THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA).

B. Temporary Control System Description

1. CONTRACTOR SHALL FURNISH AND INSTALL TEMPORARY CONTROL SYSTEMS SUCH THAT THE WESTBOUND BRIDGE DURING CONSTRUCTION IS SAFELY OPERATED, BOTH MARINE TRAFFIC AND TEMPORARY VEHICULAR AND PEDESTRIAN TRAFFIC MAINTAINED AND AVAILABLE AS REQUIRED WITHOUT INTERFERING WITH BRIDGE CONSTRUCTION WORK AND IN ACCORDANCE WITH ALL APPLICABLE CODES AND REGULATIONS. CONTRACTOR CAN IMPLEMENT TEMPORARY CONTROL SYSTEMS BASED ON ELECTRONIC, ELECTRO-

MECHANIC, HYDRAULIC OR OTHER SUITABLE MEANS AND AVAILABLE SYSTEMS TO ACHIEVE THE REQUIRED PERFORMANCE, SYSTEM AVAILABILITY AND FUNCTIONALITY AS DESCRIBED ABOVE AND UNDER THIS AND OTHER PROVISIONS. CONTRACTOR MAY ALSO BASE THE BRIDGE TEMPORARY SYSTEMS ON OTHER DESIGN ALTERNATIVES THAN DESCRIBED BELOW. HOWEVER, ALL PROPOSED TEMPORARY SYSTEMS SHALL BE DEMONSTRATED TO FULFILL REQUIRED FUNCTIONS, AND ALL REQUIRED DESIGN AND CONSTRUCTION DOCUMENTATION SHALL BE SUBMITTED TO THE ENGINEER FOR FINAL REVIEW AND APPROVAL.

- a. The temporary bridge control system shall include, but not be limited to: centralized bridge control console for the east side central control location option, or separate east and west control consoles; east and west traffic control and span control panels; span motor drive systems for all four existing 50 HP, 530 rpm, 550 V dc span motors; temporary power supply systems; temporary traffic and barrier gates control and traffic signal systems, all necessary sensing devices (such as limit switches, encoders, etc) to detect and indicate position, status or speed of span leaves, span motors, gates, traffic signals; navigation lights on piers and bascule in accordance with US Coast Guard regulations; other temporary system components of the temporary bridge control and power systems. All equipment shall be suitable for operation in an outdoor environment.
- b. The control system for the westbound bridge shall be operational during construction of the eastbound bridge and then until the new permanent control system for the eastbound bridge is furnished, installed, tested, accepted, and operational and the bridge is open to traffic. Temporary inboard bascule navigation lights will be required when the eastbound bridge is under construction. Temporary droop cables for power to bascule navigation lights shall be installed on the south side of the span.
- c. Temporary bridge controls for the northeast leaf of the westbound bridge shall be furnished and installed outside, near the east control house, or other suitable location, as approved by the Engineer.
- d. The temporary control system for the northeast leaf shall consist of a combination of existing and new equipment as seen fit by the Contractor and as allowed by the actual field conditions and construction schedule. It is acceptable to reuse existing west auxiliary controls, DC power service, and DC span drive systems if the reliable operation of these controls is tested, proven during at least three bridge operations, will not interfere with the construction work and schedule, and is approved by the Engineer and IDOT.

- e. There may be several acceptable alternative options available to implement a temporary control and power system. These options include:
- 1) Temporary west side power and controls:
 - a) Use ComEd permanent or temporary available bridge power service as the main power source during construction. It is acceptable to reuse existing 600 V dc CTA services, and the west side DC controls if tested, found operational, and approved by the Engineer, and confirmed as available during the construction by CTA.
 - b) Other acceptable options include temporary Diesel generator sets 1 x 250kW (one side) or 2 x 125kW to provide required AC and DC supply to the bridge controls, traffic gates and leaf drives. Acceptable generator set alternative is to provide minimum 125 kW, 600 V dc / 480 V ac, 3-ph, 60Hz temporary service inverter package with 480Vac/575 V ac isolation/booster transformer, and 575 V ac/ 550 V dc digital drives for the existing 50HP motors if the existing auxiliary resistor-based DC drive systems cannot be reused.
 - c) Replicate all existing control functions and safety interlocks with a distributed PLC-based or relay-based temporary bridge control system. All equipment shall be suitable for outdoor environment. Provide all temporary equipment at Engineer-approved suitable locations that will not interfere with the construction work.
 - d) Provide all necessary power and control cables and conduits, and connect to the existing equipment and devices as required. Re-use or replace with in-kind temporary traffic gate motor starters and traffic light contactors as necessary. Provide device interlocking as specified in this section.
 - e) Acceptable devices to measure leaf position and speed include absolute encoders and rotary limit switches, inclinometers, proximity switches and other similar devices. PLC shall be programmed to correctly detect and identify inputs and outputs, and be capable to calculate real-time values based on real-time data.

- 2) Evaluate the condition of existing northwest leaf power and control equipment, devices and wiring, and re-use as necessary.
- 3) Contractor may elect to consider other options such as temporary hydraulic-based leaf drive systems or similar systems with the approval of the Engineer.

C. Bridge Operation under the Temporary Control System

1. Any installed temporary control system shall be capable of performing as a minimum the bridge operation tasks as described. The northeast leaf shall be operated from the temporary control console located near the east control house; if the separate east and west control option is implemented, the northwest leaf and gates shall be operated from the existing control desks at the west control house. It is acceptable to control leaves independently from each other from the west and east side respectively, with leaf center lock and opposite side gates down and red signal interlocking between the two control systems for leaf operation permissive.
2. The leaf control master switches, which shall be selector switches with pistol grip operator or drum switches, shall provide for opening or closing of the leaf. Depressing the normal stop pushbutton will cause the leaf motors to decelerate to a reduced speed and then power will be removed from the motors and the brakes shall set. If an immediate stop is called for, the "Emergency Stop" pushbutton shall be depressed, causing power to be removed from all necessary leaf drives and thruster brake-release contactors. The leaves, that carry traffic, shall have full speed between 50 percent and 100 percent of maximum speed as dictated by the span drive system.
3. During opening of the leaves, the leaves shall begin to decelerate when leaf position reaches the nearly open position. When the leaves reach the nearly open position, the drives shall uniformly decelerate the motors, over 10 to 15 seconds, to approximately 7 percent of full speed. A "speed check" setting shall be implemented to verify the leaf slowing down by measuring span speed.
4. Leaf movement shall continue at the creep speed until the fully open limit switches are tripped, at which point the drives shall be stopped and the brakes set. The primary positional measurement devices are rotary limit switches.
5. During closing of the leaves, the leaves shall begin to decelerate when their respective positional measurement devices signify the nearly closed position (4 degrees) has been reached. When the leaves reach the nearly closed position, the drives shall uniformly decelerate over 10 to 15 seconds to approximately 7 percent of full speed.

6. Leaf movement shall continue at the creep speed until just before the fully seated position. When the fully seated limit switches set, power is taken off the motors and the leaf brakes set. The primary positional measurement devices are rotary limit switches. A "speed check" setting shall be implemented to verify the leaf slowing down by measuring span speed.
 7. Upon initiation of leaf movement, the leaf drives shall uniformly accelerate and decelerate as previously described.
- D. Temporary Control System Interlocking Requirements
1. THE TEMPORARY CONTROL SYSTEM SHALL PERFORM THE VARIOUS CONTROL OPERATIONS INTERLOCKED SUCH THAT THEY CAN BE PERFORMED ONLY IN THEIR PROPER SEQUENCE AND THAT NO DAMAGE CAN RESULT FROM AN INCORRECT OPERATION. THIS INTERLOCKING SHALL BE ARRANGED AS FOLLOWS:
 2. THE NORTHEAST LEAF CANNOT BE OPERATED ELECTRICALLY UNLESS ALL NORTHEAST TRAFFIC GATES AND THE BARRIER GATE ARE DOWN, AND THE CENTER LOCKS ARE PULLED.
 3. THE NORTHWEST LEAF CANNOT BE OPERATED ELECTRICALLY UNLESS ALL NORTHWEST TRAFFIC GATES ARE DOWN, AND THE CENTER LOCKS ARE PULLED.
 4. THE NORTHEAST LEAF CANNOT BE OPERATED ELECTRICALLY IF MORE THAN ONE LEAF BRAKE PER NORTHEAST LEAF HAS BEEN RELEASED BY HAND.
 5. THE NORTHWEST LEAF CANNOT BE OPERATED ELECTRICALLY IF MORE THAN ONE LEAF BRAKE PER NORTHWEST LEAF HAS BEEN RELEASED BY HAND.
 6. THE CENTER LOCKS CANNOT BE OPERATED ELECTRICALLY UNLESS ALL THE LEAF BRAKES ARE RELEASED, THE NORTHEAST AND THE NORTHWEST LEAVES ARE FULLY SEATED, AND TRAFFIC AND BARRIER GATES ARE DOWN.
 7. THE TRAFFIC GATES CANNOT BE OPERATED UNLESS TRAFFIC SIGNAL IS RED. TRAFFIC SIGNAL WILL TURN TO "STOP" IF ANY GATE ARM DROPS AT 85 DEGREE OR LESS FROM VERTICAL.
 8. THE BARRIER GATES CANNOT BE OPERATED UNLESS TRAFFIC GATES ARE DOWN, AND TRAFFIC SIGNAL TURNS TO "STOP".
- E. Sequence of Operation under the Temporary Control System
1. THE CONTRACTOR SHALL SUBMIT A SEQUENCE OF BRIDGE OPERATION, BASED ON THE FOLLOWING, TO THE ENGINEER, OWNER

(IDOT), AND THE US COAST GUARD FOR REVIEW AND APPROVAL. THE DESCRIBED BRIDGE OPERATIONAL SEQUENCE IS BASED ON THE SYSTEM DESCRIBED BELOW; IF OTHER ALTERNATE TEMPORARY SYSTEM IS PROVIDED, THE DESCRIBED SEQUENCE SHALL BE MODIFIED ACCORDINGLY TO REFLECT THE PROVIDED SYSTEM.

2. THE NORTHEAST LEAF SHALL BE OPERATED FROM THE TEMPORARY CONTROL PANEL LOCATED NEAR THE EAST CONTROL HOUSE, AND THE NORTHWEST LEAF SHALL BE OPERATED FROM THE EXISTING CONTROLS AT THE WEST CONTROL HOUSE. BOTH LEAVES SHALL BE CONTROLLED INDEPENDENTLY WITH INTERLOCKING BETWEEN THE SPANS.
 - a. Sequence for leaves carrying traffic:
 - 1) Open Bridge
 - a) After a boat signals for an opening, give the necessary signals with the air horns.
 - b) Turn the bridge control power switch to "On."
 - c) Turn the traffic signals switch from "Go" to "Stop," which shall immediately turn off the green traffic lights and turn on the amber traffic lights. After an adjustable time delay of five seconds, the amber lights shall be extinguished and the red traffic lights, gate warning lights, and gongs turn on.
 - d) Lower the traffic gates for the oncoming traffic.
 - e) When traffic has cleared the bridge, lower the traffic gates for the off going traffic.
 - f) Close the barrier gates.
 - g) Pull the center locks. Gongs will shut off when the center locks are pulled.
 - h) Raise the northeast and the northwest leaves to the fully open position by operating the corresponding selector switches. The leaves automatically stop.
 - 2) Close Span
 - a) After the boat has passed, sound the air horns and lower the northeast and the northwest leaves, bringing them to a fully seated position.

- b) When the fully seated light is illuminated, drive the center locks.
- c) Gongs will begin ringing again.
- d) Open the barrier gates.
- e) Raise the traffic gates.
- f) As soon as all traffic gates are raised, turn the traffic signals switch from "Stop" to "Go". Gongs will stop ringing, and the traffic signals will change to green.
- g) Turn bridge control switch to "Off."

F. Temporary Control Panel (Northeast Leaf Control Only)

1. THE TEMPORARY CONTROL PANEL SHALL BE OF NEAT, SUBSTANTIAL CONSTRUCTION, AND SHALL BE NEMA 4X RATING FOR OUTDOOR USE. IT SHALL BE FABRICATED FROM NO.10 GAUGE SHEET-STEEL, PROPERLY FORMED, AND SUITABLY REINFORCED TO PROVIDE ADEQUATE STRENGTH. LOCKABLE DOORS SHALL BE PROVIDED IN THE FRONT OF THE PANEL, PIVOTED ON 90-DEGREE HINGES, AND SECURED WITH FLUSH TYPE, THREE-POINT LATCHES. THE CONTROL OPERATORS SHALL BE MOUNTED BEHIND LOCKABLE DOORS. THE TEMPORARY CONTROL PANEL SHALL BE NEATLY FITTED UP WITH CLOSE JOINTS, ALL ROUGH EDGES OR CORNERS SHALL BE GROUND OFF SMOOTHLY, AND ALL PROJECTING EDGES ROUNDED OFF. ALL METAL HARDWARE SHALL BE OF SUBSTANTIAL CONSTRUCTION AND SHALL HAVE A SATIN-CHROME PLATE FINISH.
2. THE SHEET-STEEL PORTIONS OF THE PANEL AND ALL METAL REINFORCING SHALL BE PAINTED INSIDE WITH TWO COATS AND OUTSIDE WITH THREE COATS OF PAINT, CONSISTING OF ONE COAT OF PRIMER FOLLOWED BY TWO COATS OF ENAMEL ON THE OUTSIDE SURFACES AND ONE COAT OF RUST INHIBITING WHITE ENAMEL INSIDE. THE TWO (2) OUTSIDE FINISH COATS SHALL BE OF ANSI #61 GRAY ENAMEL. THE FOLLOWING CONTROLS SHALL BE MOUNTED ON THE TEMPORARY CONTROL PANEL:
 - a. Northeast Leaf Raise/Lower Control Switches
 - b. Normal Stop Pushbutton.
 - c. Red Emergency Stop Mushroom Pushbutton with pull to reset.

- d. Traffic Gates and Barrier Gate Raise/Lower Control Switches.
 - e. Traffic Lights Green/Red Control Switch.
 - f. Horn Pushbutton.
 - g. Northeast Leaf Fully Seated, Nearly Seated, Nearly Open, Fully Open Indicating Lights
 - h. Navigation Lights Auto/On switch.
 - i. Control Power Switch On/Off.
 - j. Drift Test Switch.
 - k. Brake Set and Released Indicating Lights.
3. THE CONTROL PANEL INTERIOR SHALL BE SUITABLY LIGHTED AND CONTROLLED BY A SWITCH MOUNTED NEAR THE FRONT DOORS. ONE DUPLEX RECEPTACLE SHALL BE MOUNTED IN THE CONTROL PANEL'S INTERIOR.
4. ALL CONTACT BLOCKS FOR CONTROL SWITCHES, PUSHBUTTONS, AND OTHER CONTROL DEVICES SHALL BE MOUNTED WITHIN THE BODY OF THE PANEL. THE OPERATORS FOR THESE DEVICES SHALL PROTRUDE THROUGH AN INTERNAL SWING OUT PANEL, BEHIND THE LOCKABLE DOORS. THE INDICATING LIGHTS FOR EACH OPERATION SHALL BE MOUNTED ADJACENT TO THE CONTROL DEVICE GOVERNING THAT OPERATION.
5. THE WIRING WITHIN THE CONTROL PANEL SHALL BE INSULATED SWITCHBOARD WIRE CONFORMING TO THE REQUIREMENTS HEREINBEFORE SPECIFIED FOR WIRING ON THE CONTROL PANELS. THE WIRING SHALL BE ARRANGED SYSTEMATICALLY SO THAT ALL CIRCUITS CAN BE READILY TRACED. ALL CONDUCTORS SHALL BE TERMINATED ON EASILY ACCESSIBLE TERMINAL BLOCKS MOUNTED INSIDE THE CONSOLE AT THE REAR. WIRING SHALL BE IDENTIFIED AT EQUIPMENT TERMINALS BY MARKING THE ADJACENT AREA WITH BRIGHT YELLOW PAINTED NUMBERS TO CORRESPOND TO CONDUCTOR DESIGNATIONS APPEARING ON THE CONTRACTOR'S WIRING DIAGRAMS.
6. INDICATING LIGHTS SHALL BE MOUNTED ON THE CONTROL PANEL TO SHOW THAT THE VARIOUS STEPS IN THE SEQUENCE OF OPERATION HAVE TAKEN PLACE SO THAT THE OPERATOR MAY PROCEED TO SUBSEQUENT STEPS AT THE PROPER TIME.

III. CONSTRUCTION DETAILS

A. Submission of Proposed Method of Installation

1. THE CONTRACTOR SHALL SUBMIT, IN DETAIL, HIS PROPOSED METHOD FOR INSTALLING THE TEMPORARY CONTROL SYSTEM, AND SHALL OBTAIN THE APPROVAL OF THE ENGINEER BEFORE ANY WORK IS STARTED.

B. Working Drawings

1. THE CONTRACTOR SHALL PREPARE AND SUBMIT TO THE ENGINEER FOR APPROVAL THE FOLLOWING WORKING DRAWINGS EXECUTED IN ACCORDANCE WITH THE PROVISIONS OF THE CONTRACT:
 - a. A drawing to scale showing the location, layout, and wiring diagrams of control panel and control cabinets, drives and limit switches together with the proposed method of installing the cables. This drawing shall be submitted and approved prior to placing a cable order with any manufacturer.
 - b. Typical published test data showing physical and electrical characteristics of the proposed drives, wiring and limit switches.
 - c. Manufacturer's construction drawings of control panels showing the new and existing circuit breakers, starters, contactors, solid state drives, etc.
 - d. Detail drawings showing the construction of any necessary terminal boxes and cabinets and all equipment and components mounted therein. Terminal tagging must be shown prior to cable and wire installation.
 - e. A complete interconnection diagram(s) for all electrical apparatus and equipment used in the operation of the span and its auxiliaries. The diagram(s) shall be of the point-to-point type and shall show the external connections of all devices and equipment. Computer-generated interconnection lists will not be acceptable in lieu of a true interconnection diagram.
 - f. The Contractor shall submit for inspection and test, if directed by the Engineer, samples of any apparatus or device, which he proposes to use as a part of the electrical installation.

C. Temporary Control System Installation

1. THE CONTRACTOR SHALL PROVIDE PROPER EQUIPMENT FOR LIFTING OR LOWERING THE TEMPORARY CONTROL SYSTEM

COMPONENTS AT THE LOCATION WHERE THE EQUIPMENT WILL BE INSTALLED. HE SHALL EXERCISE PROPER CARE SO AS NOT TO OVER STRESS, SCORE, OR DAMAGE THE CONTROL PANEL, CABINETS, TERMINAL BOXES, CABLES AND WIRING.

D. Testing

2. FACTORY INSPECTION AND TESTING

- a. The temporary control cabinets, control panel, and other apparatus fabricated or assembled by the control system vendor shall be subjected to shop inspection and test to demonstrate compliance with all specified requirements. The inspection is intended as a means of facilitating the work and avoiding errors, and it is expressly understood that it will not relieve the Contractor of responsibility for imperfect material or workmanship. Such temporary bridge control system components include control consoles and panels, PLC systems with customized software, control panels, leaf drives, and other additional equipment. The Engineer reserves the right to add other related components to further verify the operation of the systems.
- b. Special testing shall include complete verification, adjustment, and testing of the electrical control system regulator circuits and equipment using regulator simulators as necessary.
- c. All tests required herein shall be witnessed by the Engineer or his authorized representative, and no equipment shall be shipped from the factory until it has been released for shipment by the Engineer. The Contractor shall provide notification sufficiently in advance of the date of the tests so that arrangements can be made for the Engineer to be present at the tests.
- d. During the witnessed inspection, nameplate legends, conductor identifications, instrument scales, escutcheon plate engraving, and all other details of construction shall be checked for conformity with specified requirements.

3. MANUFACTURER'S FIELD START-UP SERVICE

- a. Included with the furnishing or refurbishing of any major items of temporary electrical equipment by the manufacturer shall be the furnishing of all necessary field supervisory start-up time by the manufacturer's Service Engineering Department to facilitate proper adjustment of the drive equipment if necessary to achieve satisfactory functioning of the drives.
- b. The manufacturer's field service engineering personnel shall be experienced in the adjustment and functioning of the particular control equipment furnished by the manufacturer and existing

equipment to be re-used. The personnel shall be capable of locating and correcting faults or defects and of obtaining from the manufacturer, without delay, new parts or replacements for apparatus that, in the opinion of the Engineer, does not perform satisfactorily.

4. FIELD TESTING

- a. The Contractor shall arrange for and provide all the necessary field tests, as directed by the Engineer, to demonstrate that the entire temporary electrical system is in proper working order and in accordance with the Plans and Specifications. The tests shall include, but not be limited to continuity and insulation resistance testing of conductors and operational testing of traffic signals, traffic gates, bascule leaves, navigation lights, center locks, and signals.
- b. Should the tests show that any piece of equipment or cable or wiring connection, in the judgment of the Engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the Contractor as to make the installation satisfactory to the Engineer and at no extra cost.

E. Bridge Operator

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF ALL BRIDGE INSTALLATIONS DURING CONSTRUCTION AND UNTIL ALL BRIDGE SYSTEMS ARE ACCEPTED BY THE OWNER (IDOT). THE CONTRACTOR SHALL ALSO PROVIDE PERSONNEL TO TRAIN OWNER'S BRIDGE PERSONNEL FOR A PERIOD OF 5 CONSECUTIVE WORKING DAYS AFTER THE CONSTRUCTION OF THE TEMPORARY CONTROL SYSTEM HAS BEEN COMPLETED, FINE-TUNED, TESTED, AND APPROVED BY THE ENGINEER. INSTRUCTORS SHALL INCLUDE, BUT NOT BE LIMITED TO, REPRESENTATIVES FROM MANUFACTURERS OF THE MAJOR EQUIPMENT AND A CONTROL ENGINEER.
2. TRAINING OF THE DESIGNATED BRIDGE OPERATIONAL PERSONNEL SHALL COMMENCE THREE (3) WEEKS PRIOR TO THE COMPLETION OF THE TEMPORARY BRIDGE CONTROL SYSTEM DATE. THIS WILL ALLOW TRAINING OF PERSONNEL WITHOUT INTERRUPTION OF NORMAL TRAFFIC FLOW.
3. THE CONTRACTOR WILL BE RESPONSIBLE TO HAVE THE BRIDGE IN OPERABLE CONDITION AT THE END OF EACH WORKDAY. THE CONTRACTOR'S BRIDGE OPERATORS WILL OPERATE THE BRIDGE DURING CONSTRUCTION, AND WILL BE RESPONSIBLE FOR ANY ADDITIONAL IDOT OPERATOR TRAINING AS MENTIONED ABOVE.

IV. METHOD OF MEASUREMENT

- A. Work on the Pay Item "Bridge Temporary Power and Controls during Construction" shall be measured on a lump sum basis.

V. BASIS OF PAYMENT

- A. Payment for Pay Item" **Bridge Temporary Power and Controls during Construction**" shall include the cost of all labor, materials, and equipment necessary to complete the installation, ready for operation.

BRIDGE OPERATION AND MAINTENANCE DURING CONSTRUCTION

I. DESCRIPTION

- A. This work includes all necessary labor and equipment to operate and maintain all bridge temporary and permanent systems including associated traffic gates, traffic signals, navigational lights and other systems until the rehabilitation of the bridge is complete and accepted by the Owner (IDOT). The time period shall include performing all necessary intermediate and final acceptance tests, and until the rehabilitated bridge is operational and the normal traffic flow is restored. The Contractor shall be responsible for safely operating and properly maintaining all bridge mechanical and electrical systems until such final acceptance by the Owner (IDOT). See the "Bridge Temporary Power and Controls during Construction" and other applicable special provisions for additional requirements.
- B. All maintenance is to be performed in accordance with the requirements of the latest edition of AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual.
- C. This item shall include all necessary operations and maintenance work to open bridge for navigation, keep the bridge available in accordance with the US Coast Guard and City of Chicago requirements, including any operational emergencies until the Owner (IDOT) designated bridge operators and other O&M personnel are trained in operating the new systems of the project.
- D. This item shall include only those openings required by regular marine traffic or as requested by the Owner (IDOT), or as required by the US Coast Guard or other agencies having jurisdiction. Openings required for Contractor's construction work such as equipment movement of barge cranes, span maintenance or testing will not be paid for under this item but will be considered incidental to that work and respective pay items. When the Contractor receives Notice to Proceed, he shall contact Owner (IDOT) – designated Bridge Operations Personnel (Director of Bridge Operations and Director of Bridge Maintenance,) to arrange for the Contractor's personnel to receive instructions and requirements on operating and maintaining the existing movable bridge. Contact names and telephone numbers shall be provided during by IDOT.

- E. The Contractor's personnel must begin training no later than 30 days after the Notice to Proceed. The Contractor shall provide openings using the existing equipment until all the bridge temporary control and power systems are installed and operational. Once operational, the temporary control system and equipment shall be used for openings until the new permanent control system and equipment for the eastbound bridge is installed and operational. Thereafter, the Contractor shall provide openings utilizing the new permanent eastbound bridge control system and equipment until the full bridge systems undergo all necessary acceptance tests and are accepted by the Owner (IDOT). The Owner-designated bridge operators and Operations and Maintenance (O&M) personnel shall begin training at the end of Stage II construction, thirty (30) days after the new CDOT approved operating and maintenance manuals are in possession of CDOT.
- F. A maintenance schedule for the electrical components may be obtained from the CDOT Engineer-in-Charge of Bridges. Contact name and telephone number shall be provided by IDOT. A lubrication schedule for the bridge machinery may also be obtained from CDOT as well as the keys for accessing the existing operator house and rest piers. When Owner's (IDOT) bridge operations and maintenance personnel are satisfied that the Contractor's O&M personnel are able to assume that responsibility, the Contractor shall assume the bridge operation and maintenance responsibilities no later than 45 days after the Notice to Proceed or at the beginning of work on the bascule span other than measurements, whichever occurs first. All operations shall be in accordance with the US Coast Guard requirements, City of Chicago requirements, Owner's (IDOT) requirements, and normal bridge operating procedures, including use of all signals as well as traffic and barrier gates.
- G. All maintenance shall be in accordance with IDOT requirements. The Contractor shall obtain all the current maintenance schedule and procedures for the existing bascule bridge from the IDOT bridge operations including the existing bridge control systems, motors and drives, limit switches and other control devices, operating machinery, center lock machinery, barrier gates and traffic gates. The Contractor shall be responsible for maintaining the bridge so it can operate in a reliable and timely fashion.
- H. The current Electrical Maintenance Schedule and Procedure for Congress Parkway Bridge shall be as required by the IDOT Bridges Section procedures including the following:
1. Visual Inspection and walk-through of entire bridge including; structure, Walkways, Machinery, Lighting, Center Locks, Platforms, and Piers.
 2. Troubleshooting, Reporting and Replacing of any damaged electrical equipment including all lighting fixtures, navigation lights, relays, contactors, timers, starters, pushbuttons, pilot lights, switches, limit switches, resistors, transformers, fuses, circuit breakers, traffic lights, street lighting, traffic gates, barrier gates, gate flashing red lights, navigational lights, and all other necessary maintenance of traffic equipment.

3. Cleaning of all electrical contactors on relays, collector rings, gate contacts and limit switches.
 4. Testing of all electrical motors including drive motors, center lock motors, brake motors, tie clutch assemblies, and traffic gate motors for proper operation.
 5. Perform monthly test opening as per US Coast Guard regulations.
 6. The power source to any equipment that has to be maintained or repaired has to be locked–or tagged–out to prevent unexpected start–up of the equipment and avoid injury to the servicing employee. In addition, there is a possibility that another source of voltage is present and therefore the device(s) should be checked with a meter(s) to determine if the device(s) are energized/live.
 7. The contractor/control system vendor shall be responsible for ensuring all components of the temporary control system are intact and that missing or damaged items are replaced.
- I. During and after the bascule span rehabilitation, the Contractor shall maintain the span in accordance with the schedule and procedures submitted to and approved by the Engineer.
 - J. The Contractor shall keep a log of all marine traffic openings according to IDOT and US Coast Guard standards and regulations including the type and name of each vessel, along with the date, time, and duration of opening. This log shall become the property of IDOT, when the Owner's (IDOT) designated operators regain control of bridge operations.
 - K. All openings shall be coordinated with CDOT Bridge Operations and Bridge Maintenance Division and in compliance with all applicable US Coast Guard requirements. An opening shall require a crew of a minimum of three (3) workers, an operator and two (2) assistants. The assistants of the work crew shall be required on the existing rest piers for manual operation of barrier gates, and providing visual confirmation of unobstructed channel during span operation. The Contractor shall be solely and fully responsible for any and all fines and penalties levied by the US Coast Guard resulting from his failure to comply with the US Coast Guard's current regulations and permit requirements for this bridge.

II. MATERIALS

None Specified

III. CONSTRUCTION REQUIREMENTS

- A. The Contractor shall provide continuously, available at all times, on-call bridge operators who have the knowledge of how to operate the bridge in all of the mechanical, hydraulic and electrical drive configurations that will occur during the

contract. Blocking of the roadway and proper traffic flow during span operation shall be achieved using traffic patterns shown on the Contract Plans. Lane closures shall be in accordance with the requirements listed on the maintenance of traffic plans. An emergency contact list shall be submitted to the Engineer with the telephone numbers of key Contractor personnel and mechanical / electrical subcontractors. This list shall be posted on the bridge approach in case emergency personnel need to contact the Contractor.

- B. In the recent past, the number of bridge openings for marine traffic has been XX vessels per year. The Contractor shall consider this as the minimum required openings per year during the course of the project.
- C. The US Coast Guard has granted the City of Chicago restricted openings for the duration of the project. The Contractor shall assume that the vessel passage schedules are prepared well in advance (scheduled opening time and date available at least 72 hours in advance) by the City of Chicago. It is the Contractor's responsibility to request and obtain the bridge opening schedule from the City of Chicago in due time, and to keep bridge available for all other emergency opening situations in compliance with the US Coast Guard policy and regulations. The Contractor must verify the restricted opening schedule with the US Coast Guard and the City of Chicago prior to the start of work.
- D. The Contractor shall be responsible to coordinate all openings with all other movable bridge operations outside of IDOT jurisdiction such as CDOT Bridge Operations, CDOT Bridge Maintenance Division, and the US Coast Guard.

IV. METHOD OF MEASUREMENT

- A. The work under the "Bridge Operation and Maintenance during Construction" item shall be measured on a lump sum basis. Each span opening shall include the complete cycle of opening the bridge to allow marine traffic to pass and closing the span to allow vehicular traffic to resume.

V. BASIS OF PAYMENT

- A. The price bid for "Bridge Operation and Maintenance during Construction" item shall include the cost of all labor; materials and equipment necessary to operate and maintain all bridge systems for both marine and land traffic for the duration of the Contract. Progress payments for Bascule Span Operation work satisfactorily completed and logged shall be made on a monthly basis.

- B. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
BRIDGE OPERATION AND MAINTENANCE DURING CONSTRUCTION	Lump Sum

FIBER OPTIC CABLE, SINGLE MODE

DESCRIPTION

The Contractor shall furnish and install loose-tube, single-mode, fiber optic cable of the number of fibers specified as shown in the plans and as directed by the Engineer.

Other ancillary components, required to complete the fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, fan-out kits, etc., shall be included in the cost of fiber optic cable and will not be paid for separately.

MATERIALS

The single-mode, fiber optic cable shall incorporate a loose, buffer-tube design. The cable shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1999 for a single sheathed, non-armored cable, and shall be new, unused and of current design and manufacture.

Fibers.

The cables shall use dispersion unshifted fibers. The optical and physical characteristics of the un-cabled fibers shall include:

The single-mode fiber shall meet EIA/TIA-492CAAA, "Detail Specification for Class Iva Dispersion-Unshifted Single-Mode Optical Fibers," and ITU recommendation G.652.D, "Characteristics of a single-mode optical fiber cable."

Physical Construction			
Requirement		Units	Value
Cladding Diameter		(μm)	125.0 \pm 0.7
Core-to-Cladding Concentricity		(μm)	\leq 0.5
Cladding Non-Circularity			\leq 0.7 %
Mode Field Diameter	1310 nm	(μm)	9.2 \pm 0.4
	1550 nm		10.4 \pm 0.5
Coating Diameter		(μm)	245 \pm 5
Colored Fiber Nominal Diameter		(μm)	253 - 259
Fiber Curl radius of curvature		(m)	> 4.0 m

Optical Characteristics			
Requirement		Units	Value
Cabled Fiber Attenuation	1310 nm	(dB/km)	≤ 0.4
	1550 nm		≤ 0.3
Point discontinuity	1310 nm	(dB)	≤ 0.1
	1550 nm		≤ 0.1
Macrobend Attenuation	Turns	Mandrel OD	
	1	32 ± 2 mm	< 0.05 at 1550 nm
	100	50 ± 2 mm	< 0.05 at 1310 nm
	100	50 ± 2 mm	< 0.10 at 1550 nm
	100	60 ± 2 mm	< 0.05 at 1550 nm
	100	60 ± 2 mm	< 0.05 at 1625 nm
Cable Cutoff Wavelength (λ_{ccf})		(nm)	< 1260
Zero Dispersion Wavelength (λ_0)		(nm)	1302 ≤ λ_0 ≤ 1322
Zero Dispersion Slope (S_0)		(ps/(nm ² •km))	≤ 0.089
Total Dispersion	1550 nm	(ps/(nm•km))	≤ 3.5
	1285-1330 nm		≤ 17.5
	1625 nm		≤ 21.5
Cabled Polarization Mode Dispersion		(ps/km ²)	≤ 0.2
IEEE 802.3 GbE - 1300 nm Laser Distance		(m)	up to 5000
Water Peak Attenuation: 1383 ± 3 nm		(dB/km)	≤ 0.4

Cable Construction

The number of fibers in each cable shall be as specified on the plans.

Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm. Each buffer tube shall contain up to 12 fibers. The fibers shall not adhere to the inside of the buffer tube.

Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding." The fibers shall be colored with ultraviolet (UV) curable inks.

Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding." Buffer tube colored stripes shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

For cables containing more than 12 buffer tubes, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only, and shall begin with the first tube. If fillers are required, they shall be placed in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and shall not be subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrink back requirements of 7 CFR 1755.900.

Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed. Fillers shall be placed so that they do not interrupt the consecutive positioning of the buffer tubes. In dual layer cables, any fillers shall be placed in the inner layer. Fillers shall be nominally 2.5 mm or 3.0 mm in outer diameter.

The central member shall consist of a dielectric, glass reinforced plastic (GRP) rod (optional steel central member). The purpose of the central member is to provide tensile strength and prevent buckling. The central member shall be over-coated with a thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

Each buffer tube shall contain a water-swellaable yarn for water-blocking protection. The water-swellaable yarn shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. It shall also be free from dirt or foreign matter. This yarn will preclude the need for other water-blocking material; the buffer-tube shall be gel-free. The optical fibers shall not require cleaning before placement into a splice tray or fan-out kit.

Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process.

Water swellaable yarn(s) shall be applied longitudinally along the central member during stranding.

Two polyester yarn binders shall be applied contrahelically with sufficient tension to secure each buffer tube layer to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking, and dielectric with low shrinkage.

For single layer cables, a water swellable tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water swellable tape shall be applied longitudinally over both the inner and outer layer. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

The cables shall contain one ripcord under the sheath for easy sheath removal.

Tensile strength shall be provided by the central member, and additional dielectric yarns as required.

The dielectric yarns shall be helically stranded evenly around the cable core.

The cables shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members (as required) and water swellable tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

The jacket or sheath shall be free of holes, splits, and blisters.

The cable jacket shall contain no metal elements and shall be of a consistent thickness.

Cable jackets shall be marked with the manufacturer's name, month and year of manufacture, sequential meter or foot markings, a telecommunication handset symbol as required by Section 350G of the National Electrical Safety Code (NESC), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more co-extruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

The shipping, storage, and operating temperature range of the cable shall be -40°C to $+70^{\circ}\text{C}$.
The installation temperature range of the cable shall be -30°C to $+70^{\circ}\text{C}$.

General Cable Performance Specifications

The fiber optic cable manufacturer shall provide documentation and certify that the fiber optic cable complies with the following EIA-455-xxx Fiber Optic Test Procedures (FOTP):

When tested in accordance with FOTP-3, "*Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components*," the change in attenuation at extreme operational temperatures (-40°C and $+70^{\circ}\text{C}$) shall not exceed 0.15 dB/km at 1550 nm for single-mode fiber and 0.3 dB/km at 1300 nm for multimode fiber.

When tested in accordance with FOTP-82, "*Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable*," a one meter length of un-aged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.

When tested in accordance with FOTP-81, "*Compound Flow (Drip) Test for Filled Fiber Optic Cable*," the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 70°C .

When tested in accordance with FOTP-41, "*Compressive Loading Resistance of Fiber Optic Cables*," the cable shall withstand a minimum compressive load of 220 N/cm (125 lbf/in) applied uniformly over the length of the sample. The 220 N/cm (125 lbf/in) load shall be applied at a rate of 2.5 mm (0.1 in) per minute. The load shall be maintained for a period of 1 minute. The load shall then be decreased to 110 N/cm (63 lbf/in). Alternatively, it is acceptable to remove the 220 N/cm (125 lbf/in) load entirely and apply the 110 N/cm (63 lbf/in) load within five minutes at a rate of 2.5 mm (0.1 in) per minute. The 110 N/cm (63 lbf/in) load shall be maintained for a period of 10 minutes. Attenuation measurements shall be performed before release of the 110 N/cm (63 lbf/in) load. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fibers and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-104, "*Fiber Optic Cable Cyclic Flexing Test*," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-25, "*Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies*," except that the number of cycles shall be two at three locations along a one meter cable length and the impact energy shall be at least 4.4 Nm (in accordance with ICEA S-87-640)", the change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-33, "*Fiber Optic Cable Tensile Loading and Bending Test*," using a maximum mandrel and sheave diameter of 560 mm, the cable shall withstand a rated tensile load of 2670N (601 lbf) and residual load of 30% of the rated installation load. The axial fiber strain shall be $\leq 60\%$ of the fiber proof level after completion of 60 minute conditioning and while the cable is under the rated installation load. The axial fiber strain shall be $\leq 20\%$ of the fiber proof level after completion of 10 minute conditioning and while the cable is under the residual load. The change in attenuation at residual load and after load removal shall not exceed 0.15 dB at 1550 nm for single mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-85, "*Fiber Optic Cable Twist Test*," a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

When tested in accordance with FOTP-37, "*Low or High Temperature Bend Test for Fiber Optic Cable*," the cable shall withstand four full turns around a mandrel of ≤ 20 times the cable diameter after conditioning for four hours at test temperatures of -30°C and $+60^{\circ}\text{C}$. Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears, or other openings. The change in attenuation shall not exceed 0.30 dB at 1550 nm for single mode fiber and 0.50 dB at 1300 nm for multimode fiber.

Quality Assurance Provision

All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel. The cable manufacturer shall be TL 9000 registered.

Packaging

Top and bottom ends of the cable shall be available for testing. Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:

- Cable Number
- Gross Weight
- Shipped Cable Length in Meters
- Job Order Number

- Product Number
- Customer Order Number
- Date Cable was Tested
- Manufacturer Order Number
- Cable Length Markings
 - a: Top (inside end of cable)
 - b: Bottom (outside end of cable)

The reel (one flange) marking shall include:

- Manufacturer
- Country of origin
- An arrow indicating proper direction of roll when handling
- Fork lift-handling illustration
- Handling Warnings.

Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:

- Manufacturer Cable Number
- Manufacturer Product Number
- Manufacturer Factory Order Number
- Customer Name
- Customer Cable Number
- Customer Purchase Order Number

- Mark for Information
- Ordered Length
- Maximum Billable Length
- Actual Shipped Length
- Measured Attenuation of Each Fiber

The cable shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 10 times its outer diameter during operation without changing the characteristics of the optical fibers.

The cable shall meet all of specified requirements under the following conditions:

- Shipping/storage temperature: -58° F to +158° F (-50° C to +70° C)
- Installation temperature: -22° F to +158° F (-30° C to +70° C)
- Operating temperature: -40° F to +158° F (-40° C to +70° C)
- Relative humidity from 0% to 95%, non-condensing

Optical Patch Cords and Pigtails

The optical patch cords and pigtails shall comply with the following:

- The optical patch cords shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the optical patch cords and pigtails shall meet or exceed the requirements for approved connectors specified herein.
- The fiber portion of each patch cord and pigtail shall be a single, jacketed fiber with optical properties identical to the optical cable furnished under this contract.
- The twelve fiber single-mode fiber optic cable shall be installed as a pigtail with factory installed ST compatible connectors.
- The patch cords shall comply with Telcordia GR-326-CORE

Connectors

The optical connectors shall comply with the following:

- All connectors shall be factory installed ST compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- All fibers shall be connectorized at each end.
- All fibers shall terminate at a fiber patch panel
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- Termination shall be facilitated by splicing factory OEM pigtails on the end of the bare fiber utilizing the fusion splicing method. Pigtails shall be one meter in length.

CONSTRUCTION REQUIREMENTS

Experience Requirements

Personnel involved in the installation, splicing and testing of the fiber optic cables shall meet the following requirements:

- A minimum of three (3) years experience in the installation of fiber optic cables, including fusion splicing, terminating and testing single mode fibers.
- Install two systems where fiber optic cables are outdoors in conduit and where the systems have been in continuous satisfactory operation for at least two years. The Contractor shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the installed fiber optic systems.

- One fiber optic cable system (which may be one of the two in the preceding paragraph), which the Contractor can arrange for demonstration to the Department representatives and the Engineer.

Installers shall be familiar with the cable manufacturer's recommended procedures for installing the cable. This shall include knowledge of splicing procedures for the fusion splicer being used on this project and knowledge of all hardware such as breakout (furcation) kits and splice closures. The Contractor shall submit documented procedures to the Engineer for approval and to be used by Construction inspectors.

Personnel involved in testing shall have been trained by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training shall be submitted to the Engineer for approval. In addition, the Contractor shall submit documentation of the testing procedures and a copy of the test equipment operation manual for approval by the Engineer.

Installation in Raceways

The Contractor shall provide a cable-pulling plan, identifying where the cable will enter the underground system and the direction of pull. This plan will address locations where the cable is pulled out of a handhole, coiled in a figure eight, and pulled back into the hand hole. The plan shall address the physical protection of the cable during installation and during periods of downtime. The cable-pulling plan shall be provided to the Engineer for approval a minimum of 15 working days prior to the start of installation. The Engineer's approval shall be for the operation on the freeway and does not include an endorsement of the proposed procedures. The Contractor is responsible for the technical adequacy of the proposed procedures.

During cable pulling operations, the Contractor shall ensure that the minimum bending of the cable is maintained during the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the handhole conduit ports. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation-bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the cable manufacturers specifically approve the array.

The pulling tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable. Fuse links and breaks can be used to ensure that the cable tensile strength is not exceeded. The pulling system shall have an audible alarm that sounds whenever a pre-selected tension level is reached. Tension levels shall be recorded continuously and shall be given to the Engineer.

The cable shall be pulled into the conduit as a single component, absorbing the pulling force in all tension elements. The central strength member and Aramid yarn shall be attached directly to the pulling eye during cable pulling. "Basket grip" or "Chinese-finger type" attachments, which only attach to the cable's outer jacket, shall not be permitted. A breakaway swivel, rated at 95% of the cable manufacturer's approved maximum tensile loading, shall be used on all pulls. When simultaneously pulling fiber optic cable with other cables, separate grooved rollers shall be used for each cable.

To minimize the exposure of the backbone cable and to facilitate the longer lengths of fiber optic cable, the Contractor shall use a "blown cable" (pneumatically assisted) technique to place the fiber optic cable.

Where cable is to be pulled through existing conduit which contains existing cables, optical or other, the existing cables shall be removed and reinstalled with the fiber optic cable as indicated on the plans. The removal of the cable(s) shall be paid for separately. Reinstallation of the existing cables, if indicated on the plans, along with the fiber optic cable shall be included in this item for payment.

Construction Documentation Requirements

Installation Practices for Outdoor Fiber Optic Cable Systems

The Contractor shall examine the proposed cable plant design. At least one month prior to starting installation of the fiber optic cable plant, the Contractor shall prepare and submit to the Engineer for review and approval, ten (10) copies of the Contractor's "Installation Practices for Outdoor Fiber Optic Cable Systems" manual. This manual shall address the Contractor's proposed practices covering all aspects of the fiber optic cable plant. This submittal shall include all proposed procedures, list of installation equipment, and splicing and test equipment. Test and quality control procedures shall be detailed as well as procedures for corrective action.

Operation and Maintenance Documentation

After the fiber optic cable plant has been installed, ten (10) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

- Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.
- Final copies of all approved test procedures
- Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.

- Complete parts list including names of vendors.

Testing Requirements

The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and unterminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an Optical Time Domain Reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer. Unterminated (non-connectorized) fibers shall be tested with an approved bare fiber adapter.

The Contractor shall provide the date, time and location of any tests required by this specification to the Engineer at least 5 days before performing the test. Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A Certified Technician utilizing an Optical Time Domain Reflectometer (OTDR) and Optical Source/Power Meter shall conduct the installation test. The Technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers.

At the completion of the test, the Contractor shall provide two copies of documentation of the test results to the Project Engineer. The test documentation shall be submitted as both a bound copy and a CDROM and shall include the following:

Cable & Fiber Identification:

- Cable ID
- Cable Location - beginning and end point
- Fiber ID, including tube and fiber color
- Wavelength
- Pulse width (OTDR)
- Refractory index (OTDR)
- Operator Name
- Date & Time
- Setup Parameters
- Range (OTDR)
- Scale (OTDR)
- Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR Test results
- Total Fiber Trace
- Splice Loss/Gain
- Events > 0.10 dB
- Measured Length (Cable Marking)
- Total Length (OTDR)
- Optical Source/Power Meter Total Attenuation (dB/km)

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

The OTDR test results file format must be Bellcore/Telcordia compliant according to GR-196-CORE Issue 2, OTDR Data Standard, GR 196, Revision 1.0, GR 196, Revision 1.1, GR 196, Revision 2.0 (SR-4731) in a ".SOR" file format. These results shall also be provided in tabular form, see sample below:

Sample OTDR Summary					
Cable Designation:	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date:	<i>1/1/00</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)		
			1310 nm	1550 nm	
<i>1</i>	<i>Splice</i>	<i>23500 Ft.</i>	<i>.082</i>	<i>.078</i>	
<i>1</i>	<i>Splice</i>	<i>29000 Ft.</i>	<i>.075</i>	<i>.063</i>	
<i>2</i>	<i>Splice</i>	<i>29000 Ft.</i>	<i>.091</i>	<i>.082</i>	
<i>3</i>	<i>Splice</i>	<i>26000 Ft.</i>	<i>.072</i>	<i>.061</i>	
<i>3</i>	<i>Bend</i>	<i>27000 Ft.</i>	<i>.010</i>	<i>.009</i>	

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.5 dB/km at both 1310 and 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair that cable run at the no additional cost to the state, both labor and materials. Elevated attenuation due to exceeding the pulling tension during installation shall require the replacement of the cable run at no additional cost to the State, including labor and materials.

Splicing Requirements

Splices shall be made at locations shown on the Plans. Any other splices shall be permitted only with the approval of the Engineer. Splices will be paid for separately.

Slack Storage of Fiber Optic Cables.

Included as a part of this item, slack fiber shall be supplied as necessary to allow splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored in accordance with the fiber optic cable manufacturer's guidelines.

Unless otherwise indicated in the plans, fiber optic cable slack shall be as follows as a minimum. If the plans indicate larger slack quantities, those lengths shall then be used.

Fiber optic cable slack shall be 100 feet for each cable at each handhole or pull point location, not in a structure, above or below ground.

Fiber optic cable slack shall be 50 feet for each cable at interior locations, i.e. in buildings.

This slack shall be measured for payment.

Fiber optic cable shall be tagged inside handholes with yellow tape containing the text: "CAUTION - FIBER OPTIC CABLE." In addition, permanent tags, as approved by the engineer, shall be attached to all cable in a hand hole or other break-out environment. These tags shall be stainless steel, nominally 0.75" by 1.72", and permanently embossed. These tags shall be attached with stainless steel straps, and shall identify the cable number, the number of fibers, and the specific fiber count. Tags and straps shall be Panduit or approved equal.

Label the destination of each trunk cable onto the cable in each handhole, vault or cable termination panel.

METHOD OF MEASUREMENT:

The Fiber Optic Cable will not be measured. Payment will be made based on the amount bid for the item in the proposal.

BASIS OF PAYMENT:

Payment will be made under:

Pay Item
Fiber Optic Cable

Payment for the Fiber Optic Cable shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

FIBER OPTIC SPLICE

DESCRIPTION.

The Contractor will splice optical fibers from different cable sheaths and protect them with a splice closure at the locations shown on the Plans. Fiber splicing consists of in-line fusion splices for all fibers described in the cable plan at the particular location.

Two splices are identified. A mainline splice includes all fibers in the cable sheath. In a lateral splice, the buffer tubes in the mainline cable are dressed out and those fibers identified on the plans are accessed in and spliced to lateral cables.

MATERIALS

Splice Closures. Splice Closures shall be designed for use under the most severe conditions such as moisture, vibration, impact, cable stress and flex temperature extremes as demonstrated by successfully passing the factory test procedures and minimum specifications listed below:

Physical Requirements. The closures shall provide ingress for up to four cables in a butt configuration. The closure shall prevent the intrusion of water without the use of encapsulates.

The closure shall be capable of accommodating splice organizer trays that accept mechanical, or fusion splices. The splice closure shall have provisions for storing fiber splices in an orderly manner, mountings for splice organizer assemblies, and space for excess or un-spliced fiber. Splice organizers shall be re-enterable. The splice case shall be UL rated.

Closure re-entry and subsequent reassembly shall not require specialized tools or equipment. Further, these operations shall not require the use of additional parts.

The splice closure shall have provisions for controlling the bend radius of individual fibers to a minimum of 38 mm (1.5 in.).

Factory Testing

Compression Test. The closure shall not deform more than 10% in its largest cross-sectional dimension when subjected to a uniformly distributed load of 1335 N at temperatures of -18 and 38 degrees Celsius (0 and 100 degrees Fahrenheit). The test shall be performed after

stabilizing at the required temperature for a minimum of two hours. It shall consist of placing an assembled closure between two flat parallel surfaces, with the longest closure dimension parallel to the surfaces. The weight shall be placed on the upper surface for a minimum of 15 minutes. The measurement shall then be taken with weight in place.

Impact Test. The assembled closure shall be capable of withstanding an impact of 28 N-M at temperatures of –18 and 38 degrees Celsius (0 and 100 degrees Fahrenheit). The test shall be performed after stabilizing the closure at the required temperature for a minimum of 2 hours. The test fixture shall consist of 9 kg (20 lb) cylindrical steel impacting head with a 50 mm (2 in.) spherical radius at the point where it contacts the closure. It shall be dropped from a height of 305 mm (12 in.). The closure shall not exhibit any cracks or fractures to the housing that would preclude it from passing the water immersion test. There shall be no permanent deformation to the original diameter or characteristic vertical dimension by more than 5%.

Cable Gripping and Sealing Testing. The cable gripping and sealing hardware shall not cause an increase in fiber attenuation in excess of 0.05 dB/fiber @ 1550 nm when attached to the cables and the closure assembly. The test shall consist of measurements from six fibers, one from each buffer tube or channel, or randomly selected in the case of a single fiber bundle. The measurements shall be taken from the test fibers before and after assembly to determine the effects of the cable gripping and sealing hardware on the optical transmission of the fibers.

Vibration Test. The splice organizers shall securely hold the fiber splices and store the excess fiber. The fiber splice organizers and splice retaining hardware shall be tested per EIA Standard FOTP-II, Test Condition 1. The individual fibers shall not show an increase in attenuation in excess of 0.1 dB/fiber.

Water Immersion Test. The closure shall be capable of preventing a 3 m (10 ft) water head from intruding into the splice compartment for a period of 7 days. Testing of the splice closure is to be accomplished by the placing of the closure into a pressure vessel and filling the vessel with tap water to cover the closure. Apply continuous pressure to the vessel to maintain a hydrostatic head equivalent 3 m (10 ft) on the closure and cable. This process shall be continued for 30 days. Remove the closure and open to check for the presence of water. Any intrusion of water in the compartment containing the splices constitutes a failure.

Certification. It is the responsibility of the Contractor to insure that either the manufacturer, or an independent testing laboratory has performed all of the above tests, and the appropriate documentation has been submitted to the Department. Manufacturer certification is required for the model(s) of closure supplied. It is not necessary to subject each supplied closure to the actual tests described herein.

CONSTRUCTION REQUIREMENTS

The closure shall be installed according to the manufacturer's recommended guidelines. For mainline splices, the cables shall be fusion spliced. 45 days prior to start of the fiber optic cabling installation, the Contractor shall submit the proposed locations of the mainline splice points for review by the Department.

The Contractor shall prepare the cables and fibers in accordance with the closure and cable manufacturers' installation practices. A copy of these practices shall be provided to the Engineer 21 days prior to splicing operations.

Using a fusion splicer, the Contractor shall optimize the alignment of the fibers and fuse them together. The Contractor shall recoat the fused fibers and install mechanical protection over them.

Upon completing all splicing operations for a cable span, the Contractor shall measure the mean bi-directional loss at each splice using an Optical Time Domain Reflectometer. This loss shall not exceed 0.1 dB.

The Contractor shall measure the end-to-end attenuation of each fiber, from connector to connector, using an optical power meter and source. This loss shall be measured at from both directions and shall not exceed 0.5 dB per installed kilometer of single mode cable. Measurements shall be made at both 1300 and 1550 nm for single mode cable. For multimode cable, power meter measurements shall be made at 850 and 1300 nm. The end-to-end attenuation shall not exceed 3.8 dB/installed kilometers at 850nm or 1.8 dB per installed kilometer at 1300nm for multimode fibers.

As directed by the Engineer, the Contractor at no additional cost to the Department shall replace any cable splice not satisfying the required objectives.

The Contractor shall secure the Splice Closure to the side of the splice facility using cable support brackets. All cables shall be properly dressed and secured to rails or racks within the manhole. No cables or enclosures will be permitted to lie on the floor of the splice facility. Cables that are spliced inside a building will be secured to the equipment racks or walls as appropriate and indicated on the Plans.

METHOD OF MEASUREMENT:

The Fiber Optic Splice will not be measured. Payment will be made based on the amount bid for the item in the proposal.

BASIS OF PAYMENT:

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit.</u>
Fiber Optic Splice	Lump Sum

Payment for the Fiber Optic Splice shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

CLEANING AND PAINTING CONTACT SURFACE AREAS OF EXISTING STEEL STRUCTURES

Effective: June 30, 2003

Revised: January 1, 2007

Description. This work shall consist of the surface preparation and painting of existing steel structures in areas that will be in contact with new steel.

The existing steel at primary connections (faying surfaces) shall be prepared, and primed as specified herein prior to connecting new structural steel to the existing structure.

The existing steel at secondary connections shall be prepared, and if bare metal is exposed, primed as specified herein prior to connecting new structural steel to the existing structure.

General. The existing coatings shall be assumed to contain lead and may also contain other toxic metals. Any plans that may be furnished for the work, and any dimensions or other information given regarding a structure, are only for the purpose of assisting bidders in determining the type and location of steel to be cleaned and painted. It is the responsibility of the Contractor to verify this information and the accuracy of the information provided shall in no way affect the price bid for structural steel.

Materials. The Bureau of Materials and Physical Research has established a list of all products that have met preliminary requirements. Each batch of material must be tested and approved before use.

The paint materials shall meet the requirements of the following articles of the Standard Specification:

Item Article

- a) Organic Zinc Rich Primer (Note 1)
- b) Aluminum Epoxy Mastic 1008.03

Note 1: These material requirements shall be according to the Special Provision for the Organic Zinc-Rich Paint System.

Submittals:

- a) Manufacturer's application instructions and product data sheets. Copies of the paint manufacturer's application instructions and product data sheets shall be furnished to the Engineer at the field site before steel cleaning begins.
- b) Waste Management Plan. The Waste Management Plan shall address all aspects of waste handling, storage, testing, hauling and disposal. Include the names, addresses, and a contact person for the proposed licensed waste haulers and disposal facilities. Submit the name and qualifications of the laboratory proposed for Toxicity Characteristic Leaching Procedure (TCLP) analysis.

- c) Quality Control (QC) Program. The QC Program shall identify the following; the instrumentation that will be used, a schedule of required measurements and observations, procedures for correcting unacceptable work, and procedures for improving surface preparation and painting quality as a result of quality control findings.

Construction Requirements. The Contractor shall perform first line, in process QC inspections. The Contractor shall implement the submitted and accepted QC Program to insure that the work accomplished complies with these specifications. The designated Quality Control inspector shall be onsite full time during any operations that affect the quality of the coating system (e.g., surface preparation, coating mixing and application, and evaluations between coats and upon completion of the work). The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 30 foot candles (325 LUX). Illumination for cleaning and priming, including the working platforms, access, and entryways shall be at least 20 foot candles (215 LUX).

The Contractor shall be responsible for any damage caused to persons, vehicles, or property, except as indemnified by the Response Action Contractor Indemnification Act. Whenever the intended purposes of the protective devices are not being accomplished, as determined by the Engineer, work shall be immediately suspended until corrections are made. Painted surfaces damaged by any Contractor's operation shall be removed and repainted, as directed by the Engineer, at the Contractor's expense.

Weather Conditions. Surfaces to be primed after cleaning shall remain free of moisture and other contaminants. The Contractor shall control his/her operations to insure that dust, dirt, or moisture does not come in contact with surfaces cleaned prior to painting. Surfaces painted shall be protected until the coating is sufficiently cured to protect itself from damage.

Restrictions on ambient conditions shall be as per the coating manufacturer's written specifications.

Surface Preparation: Prior to making connections or painting, all loose abrasives, paint, and residue shall be contained, collected, removed from the surface area and properly disposed of as specified later in this specification.

Painted surfaces of new steel damaged by abrasive blasting or by the Contractor's operations shall be repainted, as directed by the Engineer, at the Contractor's expense.

- a) **Primary Connections.** Primary connections shall be defined as faying (contact) surfaces of high-strength bolted splices in main, load-carrying members, end diaphragms, end cross-frames, and other areas specifically noted in plans (such as cross-frame connections on curved girders, etc.). These will typically occur where existing splices are replaced or new splices are added.

The surfaces of existing steel in all areas that will be in direct contact with new steel shall be prepared according to SSPC-SP15, Commercial Grade Power Tool Cleaning using vacuum-shrouded power tools equipped with HEPA filtration. The surface preparation shall remove all rust, mill scale, and existing paint from the contact surface. At the Contractors option,

vacuum blast cleaning according to SSPC-SP6, Commercial Blast Cleaning may be substituted for SSPC-SP15 at no additional cost to the Department. The surface profile for primary connection surfaces shall be 1.5 to 3.5 mils (38 to 90 microns).

- b) **Secondary Connections.** Secondary connections shall be defined as all surface areas of existing members that will be in contact with new steel except as previously defined as primary connections.

These surfaces of existing steel in all areas that will be in direct contact with new steel shall be prepared according to SSPC-SP3, Power Tool Cleaning using vacuum-shrouded power tools equipped with HEPA filtration. The surface preparation shall remove all loose rust, loose mill scale, and loose, checked, alligatored and peeling paint from the contact surface. At the Contractors option, vacuum blast cleaning according to SSPC-SP6, Commercial Blast Cleaning or SSPC-SP15, Commercial Grade Power Tool Cleaning may be substituted for SSPC-SP3 at no additional cost to the Department. The surface profile for abrasive blast cleaning and Commercial Grade Power Tool Cleaning shall be 1.5 to 3.5 mils (38 to 90 microns).

Painting. The manufacturer's written instructions shall be followed for paint storage, mixing, thinning, application, ambient conditions, and drying times between coats. The surface shall be free of dirt, dust, and debris prior to the application of any coat. The coatings shall be applied as a continuous film of uniform thickness free of defects including, but not limited to, runs, sags, overspray, dryspray, pinholes, voids, skips, misses, and shadow-through. Defects such as runs and sags shall be brushed out immediately during application.

The Engineer will approve surface preparation prior to priming.

- a) For Primary connections the surface of the prepared steel cleaned to bare metal shall be primed with an organic zinc rich primer between 3.5 and 5.0 mils (90 and 125 microns) dry film thickness.
- b) For Secondary Connections the surface of the prepared steel cleaned to bare metal shall be painted with one coat of epoxy mastic between 5 and 7 mils (125 microns to 180 microns) in thickness. Areas not cleaned to bare metal need not be painted.

The primer shall cure according to the manufacturers instructions prior to connecting new structural steel to the existing structure.

The surrounding coating at each prepared location shall be feathered for a minimum distance of 1 1/2 in. (40 mm) to achieve a smooth transition between the prepared areas and the existing coating.

Collection, Temporary Storage, Transportation and Disposal of Waste. The Contractor and the Department are considered to be co-generators of the waste.

The Contractor is responsible for all aspects of waste collection, testing and identification, handling, storage, transportation, and disposal according to these specifications and all applicable Federal, State, and Local regulations. The Contractor shall provide for Engineer

review and acceptance a Waste Management Plan that addresses all aspects of waste handling, storage, and testing, and provides the names, addresses, and a contact person for the proposed licensed waste haulers and disposal facilities. The Department will not perform any functions relating to the waste other than provide EPA identification numbers, provide the Contractor with the emergency response information, the emergency response telephone number required to be provided on the manifest, and to sign the waste manifest. The Engineer will obtain the identification numbers from the state and federal environmental protection agencies for the bridge(s) to be painted and furnish those to the Contractor.

All surface preparation/paint residues shall be collected daily and deposited in all-weather containers supplied by the Contractor as temporary storage. The storage area shall be secure to prevent unauthorized entry or tampering with the containers. Acceptable measures include storage within a fully enclosed (e.g., fenced in) and locked area, within a temporary building, or implementing other reasonable means to reduce the possibility of vandalism or exposure of the waste to the public or the environment (e.g., securing the lids or covers of waste containers and roll-off boxes). Waste shall not be stored outside of the containers. Waste shall be collected and transferred to bulk containers taking extra precautions as necessary to prevent the suspension of residues in air or contamination of surrounding surfaces. Precautions may include the transfer of the material within a tarpaulin enclosure. Transfer into roll-off boxes shall be planned to minimize the need for workers to enter the roll-off box.

No residues shall remain on uncontained surfaces overnight. Waste materials shall not be removed through floor drains or by throwing them over the side of the bridge. Flammable materials shall not be stored around or under any bridge structures.

The all-weather containers shall meet the requirements for the transportation of hazardous materials and as approved by the Department. Acceptable containers include covered roll-off boxes and 55-gallon drums (17H). The Contractor shall insure that no breaks and no deterioration of these containers occurs and shall maintain a written log of weekly inspections of the condition of the containers. A copy of the log shall be furnished to the Engineer upon request. The containers shall be kept closed and sealed from moisture except during the addition of waste. Each container shall be permanently identified with the date that waste was placed into the container, contract number, hazardous waste name and ID number, and other information required by the IEPA.

The Contractor shall have each waste stream sampled for each project and tested by TCLP and according to EPA and disposal company requirements. The Engineer shall be notified in advance when the samples will be collected. The samples shall be collected and shipped for testing within the first week of the project, with the results due back to the Engineer within 10 days. The costs of testing shall be considered included in this work. Copies of the test results shall be provided to the Engineer prior to shipping the waste.

The existing paint removed, together with the surface preparation media (e.g. abrasive) shall be handled as a hazardous waste, regardless of the TCLP results. The waste shall be transported by a licensed hazardous waste transporter, treated by an IEPA permitted treatment facility to a non-hazardous special waste and disposed of at an IEPA permitted disposal facility in Illinois.

The treatment/disposal facilities shall be approved by the Engineer, and shall hold an IEPA permit for waste disposal and waste stream authorization for this cleaning residue. The IEPA permit and waste stream authorization must be obtained prior to beginning cleaning, except that if necessary, limited paint removal will be permitted in order to obtain samples of the waste for the disposal facilities. The waste shall be shipped to the facility within 90 days of the first accumulation of the waste in the containers. When permitted by the Engineer, waste from multiple bridges in the same contract may be transported by the Contractor to a central waste storage location(s) approved by the Engineer in order to consolidate the material for pick up, and to minimize the storage of waste containers at multiple remote sites after demobilization. Arrangements for the final waste pickup shall be made with the waste hauler by the time blast cleaning operations are completed or as required to meet the 90 day limit stated above.

The Contractor shall submit a waste accumulation inventory table to the Engineer no later than the 5th day of the month. The table shall show the number and size of waste containers filled each day in the preceding month and the amount of waste shipped that month, including the dates of shipments.

The Contractor shall prepare a manifest supplied by the IEPA for off-site treatment and disposal before transporting the hazardous waste off-site. The Contractor shall prepare a land ban notification for the waste to be furnished to the disposal facility. The Contractor shall obtain the handwritten signature of the initial transporter and date of the acceptance of the manifest. The Contractor shall send one copy of the manifest to the IEPA within two working days of transporting the waste off-site. The Contractor shall furnish the generator copy of the manifest and a copy of the land ban notification to the Engineer. The Contractor shall give the transporter the remaining copies of the manifest.

All other project waste shall be removed from the site according to Federal, State and Local regulations, with all waste removed from the site prior to final Contractor demobilization.

The Contractor shall make arrangements to have other hazardous waste, which he/she generates, such as used paint solvent, transported to the Contractor's facility at the end of each day that this waste is generated. These hazardous wastes shall be manifested using the Contractor's own generator number to a treatment or disposal facility from the Contractor's facility. The Contractor shall not combine solvents or other wastes with cleaning residue wastes. All waste streams shall be stored in separate containers.

The Contractor is responsible for the payment of any fines and undertaking any clean up activities mandated by State or federal environmental agencies for improper waste handling, storage, transportation, or disposal.

Contractor personnel shall be trained in the proper handling of hazardous waste, and the necessary notification and clean up requirements in the event of a spill. The Contractor shall maintain a copy of the personnel training records at each bridge site.

It is understood and agreed that the cost of all work outlined above, unless otherwise specified, has been included in the bid, and no extra compensation will be allowed.

Basis of Payment: This work will be considered included in the cost of "Furnishing and Erecting Structural Steel", "Erecting Structural Steel", or "Structural Steel Repair", as applicable, according to the Standard Specifications, unless otherwise specified on the plans.

CLEANING AND PAINTING NEW METAL STRUCTURES

Effective Date: September 13, 1994

Revised Date: May 11, 2009

Description. The material and construction requirements that apply to cleaning and painting new structural steel shall be according to the applicable portion of Sections 506 of the Standard Specifications except as modified herein. The three coat paint system shall be the system as specified on the plans and as defined herein. Unless stated otherwise, requirements imposed on the "Contractor" in this specification apply to both the shop painting contractor and the field painting contractor.

Materials. All materials to be used on an individual structure shall be produced by the same manufacturer. The Bureau of Materials and Physical Research has established a list of all products that have met preliminary requirements. Each batch of material must be tested and approved by that bureau before use.

The paint materials shall meet the requirements of the following articles of the Standard Specification:

<u>Item</u>	<u>Article</u>
(a) Inorganic Zinc-Rich Primer	1008.02
(b) Waterborne Acrylic	1008.04
(c) Aluminum Epoxy Mastic	1008.03
(d) Organic Zinc-Rich Primer (Note 1)	
(e) Epoxy Intermediate (Note 1)	
(f) Aliphatic Urethane (Note 1)	

Note 1: These material requirements shall be according to the Special Provision for the Organic Zinc-Rich Paint System.

Submittals. At least 30 days prior to beginning shop or field painting respectively, the Contractor shall submit for the Engineer's review and acceptance, the following applicable plans, certifications and information for completing the field work. Painting work shall not proceed until the submittals are accepted by the Engineer. Qualifications, certifications and QC plans for shop and field cleaning and painting shall be available for review by the QA Inspector.

- a) Contractor Shop Qualifications. Except for miscellaneous steel items such as bearings, side retainers, expansion joint devices, and other items allowed by the Engineer, or unless stated otherwise in the contract, the shop painting Contractors shall be certified to perform the work as follows: the shop painting Contractor shall possess AISC Sophisticated Paint Endorsement or SSPC-QP3 certification. Evidence of current qualifications shall be provided.

- b) Contractor Field Qualifications. When indicated on the contract plans, the field painting contractor shall possess current SSPC QP1 certification. Evidence of current qualifications shall be provided. The Contractor shall maintain certified status throughout the duration of the painting work under the contract. The Department reserves the right to accept Contractors documented to be currently enrolled in the SSPC-QP7, Painting Contractor Introductory Program, in lieu of the QP certifications noted above.
- c) QC Personnel Qualifications. Personnel managing the shop and field Quality Control program(s) for this work shall possess a minimum classification as a National Association of Corrosion Engineers (NACE) Coating Inspector Level 2-Certified, or shall provide evidence of successful inspection of 3 projects of similar or greater complexity and scope that have been completed in the last 2 years. Copies of the certification and/or experience shall be provided, including names, addresses and telephone numbers of contact persons employed by the bridge owner.

The personnel performing the QC tests for this work shall be trained in coatings inspection and the use of the testing instruments. Documentation of training shall be provided. The QC personnel shall not perform hands on surface preparation or paint activities unless otherwise approved by the Engineer. Painters shall perform wet film thickness measurements, with QC personnel conducting random spot checks of the wet film. The Contractor shall not replace the QC personnel assigned to the project without advance notice to the Engineer, and acceptance of the replacement(s), by the Engineer.

- d) Quality Control (QC) Program. The shop and field QC Programs shall identify the following; the instrumentation that will be used, a schedule of required measurements and observations, procedures for correcting unacceptable work, and procedures for improving surface preparation and painting quality as a result of quality control findings. The shop program shall include a copy of the quality control form(s) that will be completed daily. The field program shall incorporate the IDOT Quality Control Daily Report form, as supplied by the Engineer.
- e) Field Cleaning and Painting Inspection Access Plan. The inspection access plan for use by Contractor QC personnel for ongoing inspections and by the Engineer during Quality Assurance (QA) observations.
- f) Surface Preparation/Painting Plan. The surface preparation/painting plan shall include the methods of surface preparation and type of equipment to be utilized for solvent cleaning, abrasive blast cleaning, washing, and power tool cleaning. The plan shall include the manufacturer's names of the materials that will be used, including Product Data Sheets and Material Safety Data Sheets (MSDS).

A letter or written instructions from the coating manufacturer shall be included, indicating the required drying time for each coat at the minimum, normal, and maximum application temperatures before the coating can be exposed to temperatures or moisture conditions that are outside of the published application parameters. Application shall be performed in accordance with the coating manufacturer's instructions.

Quality Control (QC) Inspections. The Contractor shall perform first line, in process QC inspections of each phase of the work. The submitted and accepted QC Program(s) shall be used to insure that the work accomplished complies with these specifications. The shop painting Contractor shall use their forms as supplied in their submittal. These shop reports shall be made available for review when requested by the Engineer. The field painting Contractor shall use the IDOT Quality Control Daily Report form supplied by the Engineer to record the results of quality control tests. These field reports shall be turned into the Engineer before work resumes the following day.

The Contractor shall supply all necessary equipment to perform the QC inspections. Equipment shall include the following at a minimum:

Psychrometer or comparable equipment for the measurement of dew point and relative humidity, together with all necessary weather bureau tables or psychrometric charts.

Surface temperature thermometer.

Bresle Cell Kits or CHLOR*TEST kits for chloride determinations, or equivalent.(only required when erected steel is exposed through the winter prior to field painting.)

Wet Film Thickness Gage.

Blotter paper for compressed air cleanliness checks.

Type 2 Magnetic Dry Film Thickness Gage per SSPC - PA2.

Calibration standards for dry film thickness gage.

Light meter for measuring light intensity during cleaning, painting, and inspection activities.

All applicable ASTM and SSPC Standards used for the work.

Commercially available putty knife of a minimum thickness of 40 mils (1 mm) and a width between 1 and 3 in. (25 and 75 mm). Note that the putty knife is only required in touch-up areas where the coating is being feathered and must be tested with a dull putty knife.

The instruments shall be calibrated by the Contractor's personnel according to the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection equipment shall be made available to the Engineer for QA observations on an as needed basis.

Quality Assurance (QA) Observations. The Engineer may conduct QA observations of any or all phases of the shop or field work. The Engineer's observations in no way relieve the Contractor of the responsibility to provide all necessary daily QC inspections of his/her own and to comply with all requirements of this Specification.

Inspection Access and Lighting. The Contractor shall facilitate the Engineer's observations as required, including allowing ample time to view the work. The field Contractor shall furnish, erect and move scaffolding or other mechanical equipment to permit close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work. Examples of acceptable access structures include:

Mechanical lifting equipment, such as, scissor trucks, hydraulic booms, etc.

Platforms suspended from the structure comprised of trusses or other stiff supporting members and including rails and kick boards.

Simple catenary supports are permitted only if independent life lines for attaching a fall arrest system according to Occupational Safety and Health Administration (OSHA) regulations are provided.

When the surface to be inspected is more than 6 ft. (1.8 m) above the ground or water surface, and fall protection is not provided (e.g. guardrails) the Contractor shall provide the Engineer with a safety harness and a lifeline according to OSHA regulations. The lifeline and attachment shall not direct the fall into oncoming traffic. The Contractor shall provide a method of attaching the lifeline to the structure independent of the inspection facility or any support of the platform. When the inspection facility is more than 2 1/2 ft. (800 mm) above the ground, the Contractor shall provide an approved means of access onto the platform.

The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 30 foot candles (325 LUX). Illumination for cleaning and painting, including the working platforms, access, and entryways shall be at least 20 foot candles (215 LUX).

Construction Requirements for Field Painting. The Contractor shall be responsible for any damage caused to persons, vehicles, or property, except as indemnified by the Response Action Contractor Indemnification Act. Whenever the intended purposes of the protective devices are not being accomplished, as determined by the Engineer, work shall be immediately suspended until corrections are made. Painted surfaces damaged by any Contractor's operation shall be removed and repainted, as directed by the Engineer, at the Contractor's expense.

The Contractor shall comply with the provisions of the Illinois Environmental Protection Act. Paint drips, spills, and overspray are not permitted to escape into the air or onto any other surfaces or surrounding property not intended to be painted. Containment shall be used to control paint drips, spills, and overspray, and shall be dropped and all equipment secured when sustained wind speeds of 40 mph (64 kph) or greater occur, unless the containment design necessitates action at lower wind speeds. When the containment needs to be attached to the structure, it shall be attached by clamping or similar means. Welding or drilling into the structure shall be prohibited unless otherwise approved by the Engineer in writing. The Contractor shall evaluate project-specific conditions to determine the specific type and extent of containment needed to control the paint emissions and shall submit a plan for containing or controlling paint debris (droplets, spills, overspray, etc.) to the Engineer for approval prior to starting the work. Approval shall not relieve the Contractor of their ultimate responsibility for controlling paint debris from escaping the work zone.

Hold Point Notification for Field Painting. Specific inspection items throughout this specification are designated as Hold Points. Unless other arrangements are made at the project site, the Contractor shall provide the Engineer with a minimum 4-hour notification before a Hold Point inspection will be reached. If the 4-hour notification is provided and the Work is ready for inspection at that time, the Engineer will conduct the necessary observations. If the Work is not ready at the appointed time, unless other arrangements are made, an additional 4-hour notification is required. Permission to proceed beyond a Hold Point without a QA inspection will

be granted solely at the discretion of the Engineer, and only on a case by case basis. The Engineer has the right to reject any work that was performed without adequate provision for QA observations

Field Surface Preparation (HOLD POINT). The following processes shall be used to prepare the shop-coated steel surfaces for field painting.

1. Low Pressure Water Cleaning and Solvent Cleaning. The Contractor shall notify the Engineer 24 hours in advance of beginning surface preparation operations.

Washing shall involve the use of potable water at a minimum of 1000 psi (7 MPa) and less than 5000 psi (34 MPa) according to “Low Pressure Water Cleaning” of SSPCSP12. Paint spray equipment shall not be used to perform the water cleaning. The cleaning shall be performed in such a manner as to remove dust, dirt, chalk, insect and animal nests, bird droppings, and other foreign matter prior to solvent cleaning.

If detergents or other additives are added to the water, the detergents/additives shall be included in the submittals and not used until accepted by the Engineer. When detergents or additives are used, the surface shall be rinsed with potable water before the detergent water dries.

After washing has been accepted by the Engineer, all traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants which remain on the steel surfaces to be painted shall be removed according to SSPC – SP1 Solvent Cleaning, supplemented with scraping (e.g., to remove large deposits of asphaltic cement) as required. The solvent(s) used for cleaning shall be compatible with the primer. The Contractor shall identify the proposed solvent(s) in the submittals. If the primer is softened, wrinkled, or shows other signs of attack from the solvents, the Contractor shall immediately discontinue their use. The name and composition of replacement solvents, together with MSDS, shall be submitted for Engineer acceptance prior to use. If solvent cleaning/scraping is not successful in removing the foreign matter, the Contractor shall use other methods identified in SP1, such as steam cleaning as necessary.

1 Water Cleaning Between Coats. When foreign matter has accumulated on a newly applied coat, washing shall be performed prior to the application of subsequent coats.

2 Power Tool Cleaning of Shop-Coated Steel. Damaged and rusted areas shall be spot cleaned according Power Tool Cleaning SSPC-SP3 (Modified). The edges of the coating surrounding the spot repairs shall be feathered. A power tool cleaned surface shall be free of all loose rust, loose and peeling paint, and loose rust that is bleeding through and/or penetrating the coating. All locations of visible corrosion and rust bleed, and lifting or loose paint shall be prepared using the power tools.

Upon completion of the cleaning, rust, rust bleed, and surrounding paint are permitted to remain if they cannot be lifted using a dull putty knife.

Field Soluble Salt Remediation (HOLD POINT). If the erected steel is exposed to winter weather prior to field painting, the Contractor shall implement surface preparation procedures and

processes that will remove chloride from the surfaces prior to field painting. Surfaces that may be contaminated with chloride include, but are not limited to, expansion joints and all areas that are subject to roadway splash or run off such as fascia beams and stringers.

Methods of chloride removal may include, but are not limited to, steam cleaning or pressure washing with or without the addition of a chemical soluble salt remover as approved by the coating manufacturer, and scrubbing before or after initial paint removal. The water does not need to be collected. The Contractor shall provide the proposed procedures for chloride remediation in the Surface Preparation/Painting Plan.

Upon completion of the chloride remediation steps, the Contractor shall use cell methods of field chloride extraction and test procedures (e.g., silver dichromate) accepted by the Engineer, to test representative surfaces for the presence of remaining chlorides. Remaining chloride levels shall be no greater than $7\mu\text{g}/\text{sq cm}$ as read directly from the surface without any multiplier applied to the results. The testing must be performed, and the results must be acceptable.

Surface and Weather Conditions (HOLD POINT). Surfaces to be painted after cleaning shall remain free of moisture and other contaminants. The Contractor shall control his/her operations to insure that dust, dirt, or moisture does not come in contact with surfaces cleaned or painted that day.

Prepared surfaces, shall meet the requirements of the respective degrees of cleaning immediately prior to painting, and shall be painted before rusting appears on the surface. If rust appears or bare steel remains unpainted for more than 12 hours, the affected area shall be prepared again at the expense of the Contractor.

The surface temperature shall be at least 5°F (3°C) above the dew point during final surface preparation operations. The paint manufacturers' published literature shall be followed for specific temperature, dew point, and humidity restrictions during the application of each coat, and for the minimum and maximum time between coats.

The Contractor shall monitor temperature, dew point, and humidity every 4 hours during surface preparation and coating application in the specific areas where the work is being performed. The frequency of monitoring shall increase if weather conditions are changing. The Engineer has the right to reject any work that was performed under unfavorable weather conditions. Rejected work shall be removed, and repainted at the Contractor's expense.

Seasonal Restrictions on Field Cleaning and Painting. Field cleaning and painting work shall be accomplished between April 15 and October 31 unless authorized otherwise by the Engineer in writing.

Inorganic Zinc-rich/ Waterborne Acrylic Paint system. This system shall be for shop and field application of the coating system. Shop application of the intermediate and top coats will not be allowed.

In the shop, all structural steel designated to be painted shall be given one coat of inorganic zinc rich primer. In the field, before the application of the intermediate coat, the prime coat and any newly installed fasteners shall be spot solvent cleaned per SSPC-SP 1 and all surfaces

pressure washed as specified above. All damaged shop primed areas shall be spot cleaned per SSPC-SP3 Modified, All damaged areas and all installed fasteners shall be fully primed with aluminum epoxy mastic. The structural steel shall then receive one full intermediate coat and one full topcoat of waterborne acrylic paint.

- a) Coating Dry Film Thickness (dft), measured according to SSPC-PA2:
Zinc Primer: 3 mils (75 microns) min., 6 mils (150 microns) max.
Epoxy Mastic(spot coat): 5 mils (125 microns) min., 7 mils (180 microns) max.
Intermediate Coat: 2 mils (50 microns) min., 4 mils (100 microns) max.
Topcoat: 2 mils (50 microns) min., 4 mils (100 microns) max.

The total dry film thickness, excluding the spot areas touched up with epoxy mastic, shall be between 7 and 14 mils (180 and 355 microns).

- b) The pressure washing requirement above may be waived if the QC and QA Inspectors verify the primed surfaces have not been contaminated.
- d) Damage to the completed paint system shall be spot cleaned using SSPC-SP3 (Modified). The cleaned areas shall be spot painted with a penetrating sealer as recommended by the manufacturer, which shall overlap onto the existing topcoat. Then the aluminum epoxy mastic shall be spot applied not to go beyond the area painted with the sealer. The acrylic intermediate and topcoat shall be spot applied to the mastic with at least a 6 inch (150 mm) overlap onto the existing topcoat.

Organic Zinc-Rich/ Epoxy/ Urethane Paint System. This system shall be for full shop application of the coating system, or when specified on the plans, for the application of two coats in the shop with the finish coat applied in the field. All contact surfaces shall be masked off prior to shop-application of the intermediate and top coats.

In addition to the requirements of Section 3.2.9 of the AASHTO/AWS D1.5/D1.5:2002 Bridge Welding Code (breaking thermal cut corners of stress carrying members), rolled and thermal cut corners to be painted with organic zinc primer shall be broken if they are sharper than a 1/16 in. (1.5 mm) radius. Corners shall be broken by a single pass of a grinder or other suitable device at a 45 degree angle to each adjoining surface prior to final blast cleaning, so the resulting corner approximates a 1/16 in. (1.5 mm) or larger radius after blasting. Surface anomalies (burrs, fins, deformations) shall also be treated to meet this criteria before priming.

In the shop, all structural steel designated to be painted shall be given one coat of organic zinc rich primer, one coat of epoxy intermediate, and unless stated otherwise in the plans, one coat of urethane finish. Before the application of the field coats, the shop coats and any newly installed fasteners shall be spot solvent cleaned per SSPC-SP 1 and all surfaces pressure washed as specified above to remove dirt, oil, lubricants, oxidation products, and foreign substances. All damaged shop coated areas shall then be spot cleaned per SSPC-SP3 (Modified). The surrounding coating at each repair location shall be feathered for a minimum distance of 1 1/2 in. (40 mm) to achieve a smooth transition between the prepared areas and the existing coating. The existing coating in the feathered area shall be roughened to insure proper adhesion of the repair coats.

All damaged areas and all newly installed fasteners shall be fully primed with epoxy mastic. One intermediate coat of epoxy shall be applied over the epoxy mastic and on exposed shop primer. One topcoat of aliphatic urethane shall be applied to all areas where the intermediate coat is visible, whether the intermediate coat was applied in the shop or in the field. The field applied coats shall only overlap onto the existing finish coat where sanding has been performed.

When the plans require the urethane coat to be applied in the field, the maximum recoat time for the intermediate coat shall be observed. If the recoat time for the intermediate coat is exceeded, the Contractor shall remove the shop-applied system, or submit for approval by the Engineer, written recommendations from the coating manufacturer for the procedures necessary to extend that recoat window or otherwise prepare the intermediate coat to receive the finish.

- (a) Coating Dry Film Thickness (dft), measured according to SSPC-PA2: Organic Zinc-Rich Primer: 3 mils (75 microns) min., 5 mils (125 microns) max. Aluminum Epoxy Mastic (spot coat): 5 mils (125 microns) min., 7 mils (180 microns) max. Epoxy Intermediate Coat: 3 mils (75 microns) min., 6 mils (150 microns) max. Aliphatic Urethane Top Coat: 2.5 mils (65 microns) min., 4 mils (100 microns) max.
- (b) The total dry film thickness, excluding the spot areas touched up with epoxy mastic, shall be between 8.5 and 15 mils (215 and 375 microns).
- (c) All faying surfaces of field connections shall be masked off after priming and shall not receive the intermediate or top coats in the shop. The intermediate and top coats for field connections shall be applied, in the field, after erection of the structural steel is completed.

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, the painting Contractors name, and the paint type code from the Structure Information and Procedure Manual for the system used. The letters shall be capitals, not less than 2 in. (50 mm) and not more than 3 in. (75 mm) in height. When all coats are applied in the shop the shop Contractor shall do the stenciling. When 1 or more coats are applied in the field, the field contractor shall do the stenciling.

The stencil shall contain the following wording "PAINTED BY (insert the name of the painting Contractor)" and shall show the month and year in which the painting was completed, followed by "CODE S" for the Inorganic Zinc/ Acrylic System, "CODE X" for the Organic Zinc/ Epoxy/ Urethane System (field applied finish coats), "CODE AB" for the Organic Zinc/ Epoxy/ Urethane System (shop applied), all stenciled on successive lines. This information shall be stenciled on the cover plate of a truss end post near the top of the railing, or on the outside face of an outside stringer near both ends of the bridge facing traffic, or at some equally visible surface designated by the Engineer.

Method of Measurement. Shop cleaning and painting new structures will not be measured for payment. Field cleaning and painting will not be measured for payment except when performed under a contract that contains a separate pay item for this work.

Basis of Payment. This work will be paid for according to Article 506.07.

CLEANING AND PAINTING EXISTING STEEL STRUCTURES

Effective: October 2, 2001

Revised: May 11, 2009

Description. This work shall consist of the preparation of all designated metal surfaces by the method(s) specified on the plans. This work also includes the painting of those designated surfaces with the paint system(s) specified on the plans. The Contractor shall furnish all materials, equipment, labor, and other essentials necessary to accomplish this work and all other work described herein and as directed by the Engineer.

Materials. All materials to be used on an individual structure shall be produced by the same manufacturer.

The Bureau of Materials and Physical Research has established a list of all products that have met preliminary requirements. Each batch of material, except for the penetrating sealer, must be tested and approved before use. The specified colors shall be produced in the coating manufacturer's facility. Tinting of the coating after it leaves the manufacturer's facility is not allowed.

The paint materials shall meet the following requirements of the Standard Specification and as noted below:

Item	<u>Article</u>
(a) Waterborne Acrylic	1008.04
(b) Aluminum Epoxy Mastic	1008.03
(c) Organic Zinc Rich Primer (Note 1)	
(d) Epoxy/ Aliphatic Urethane (Note 1)	
(e) Penetrating Sealer (Note 2)	
(f) Moisture Cured Zinc Rich Urethane Primer (Note 3)	
(g) Moisture Cured Aromatic/Aliphatic Urethane (Note 3)	
(h) Moisture Cured Penetrating Sealer (Note 4)	

Note 1: These material requirements shall be according to the Special Provision for the Organic Zinc-Rich Paint System.

Note 2: The Epoxy Penetrating Sealer shall be a cross-linked multi component sealer. The sealer shall have the following properties:

- (a) The volume solids shall be 98 percent (plus or minus 2 percent).
- (b) Shall be clear or slightly tinted color.

Note 3: These material requirements shall be according to the Special Provision for the Moisture Cured Urethane Paint System.

Note 4: The Moisture Cured Penetrating Sealer manufacturer's certification will be required.

Submittals. The Contractor shall submit for Engineer review and acceptance, the following plans and information for completing the work. The submittals shall be provided within 30 days of execution of the contract unless given written permission by the Engineer to submit them at a later date. Work cannot proceed until the submittals are accepted by the Engineer. Details for each of the plans are presented within the body of this specification.

- a) Contractor/Personnel Qualifications. Evidence of Contractor qualifications and the names and qualifications/experience/training of the personnel managing and implementing the Quality Control program and conducting the quality control tests.
- b) Quality Control (QC) Program. The QC Program shall identify the following; the instrumentation that will be used, a schedule of required measurements and observations, procedures for correcting unacceptable work, and procedures for improving surface preparation and painting quality as a result of quality control findings. The program shall incorporate at a minimum, the IDOT Quality Control Daily Report form as supplied by the Engineer.
- c) Inspection Access Plan. The inspection access plan for use by Contractor QC personnel for ongoing inspections and by the Engineer during Quality Assurance (QA) observations.
- d) Surface Preparation/Painting Plan. The surface preparation/painting plan shall include the methods of surface preparation and type of equipment to be utilized for washing, hand/power tool cleaning, removal of rust, mill scale, paint or foreign matter, abrasive blast or water jetting, and remediation of chloride. If detergents, additives, or inhibitors are incorporated into the water, the Contractor shall include the names of the materials and Material Safety Data Sheets (MSDS). The Contractor shall identify the solvents proposed for solvent cleaning together with MSDS.

The plan shall also include the methods of coating application and equipment to be utilized.

If the Contractor proposes to heat or dehumidify the containment, the methods and equipment proposed for use shall be included in the Plan for the Engineer's consideration.

- e) Paint Manufacturer Certifications and Letters. When a sealer is used, the Contractor shall provide the manufacturer's certification of compliance with IDOT testing requirements listed under "Materials" above. A certification regarding the compatibility of the sealer with the specified paint system shall also be included.

When rust inhibitors are used, the Contractor shall provide a letter from the coating manufacturer indicating that the inhibitor is compatible with, and will not adversely affect the performance of the coating system.

If the use of a chemical soluble salt remover is proposed by the Contractor, provide a letter from the coating manufacturer indicating that the material will not adversely effect the performance of the coating system.

The paint manufacturer's application and thinning instructions, MSDS and product data sheets shall be provided, with specific attention drawn to storage temperatures, and the temperatures of the material, surface and ambient air at the time of application. A letter or written instructions from the coating manufacturer shall be provided indicating the length of time that each coat must be protected from cold or inclement weather (e.g., exposure to rain) during its drying period.

- f) Abrasives. Abrasives to be used for abrasive blast cleaning, including MSDS. For expendable abrasives, the Contractor shall provide certification from the abrasive supplier that the abrasive meets the requirements of SSPC-AB1. For steel grit abrasives, the certification shall indicate that the abrasive meets the requirements of SSPC-AB3.
- g) Protective Coverings. Plan for containing or controlling paint debris (droplets, spills, overspray, etc.). Any tarpaulins or protective coverings proposed for use shall be fire retardant. For submittal requirements involving the containment used to remove lead paint, the Contractor shall refer to Special Provision for Containment and Disposal of Lead Paint Cleaning Residues.
- h) Progress Schedule. Progress schedule shall be submitted per Article 108.02 and shall identify all major work items (e.g., installation of rigging/containment, surface preparation, and coating application).

When the Engineer accepts the submittals, the Contractor will receive written notification. The Contractor shall not begin any paint removal work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work according to the requirements of Federal, State, or Local regulations and this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Contractor Qualifications. When indicated on the plans, for non lead abatement projects, the painting Contractor shall possess current SSPC-QP1 certification. For lead abatement projects the Contractor shall also possess current SSPC-QP2 certification. The Contractor shall maintain certified status throughout the duration of the painting work under the contract. The Department reserves the right to accept Contractors documented to be currently enrolled in the SSPC-QP7, Painting Contractor Introductory Program, Category 2, in lieu of the QP certifications noted above.

Quality Control (QC) Inspections. The Contractor shall perform first line, in process QC inspections. The Contractor shall implement the submitted and accepted QC Program to insure that the work accomplished complies with these specifications. The designated Quality Control inspector shall be onsite full time during any operations that affect the quality of the coating system (e.g., surface preparation and chloride remediation, coating mixing and application, and evaluations between coats and upon project completion). The Contractor shall use the IDOT Quality Control Daily Report form supplied by the Engineer to record the results of quality control tests. The completed reports shall be turned into the Engineer before work resumes the following day.

Contractor QC inspections shall include, but not be limited to the following:

Suitability of protective coverings and the means employed to control project debris and paint spills, overspray, etc.

Ambient conditions

Surface preparation (solvent cleaning, pressure washing including chalk tests, hand/power tool or abrasive blast cleaning, etc.)

Chloride remediation

Coating application (specified materials, mixing, thinning, and wet/dry film thickness)

Recoat times and cleanliness between coats

Coating continuity and coverage (freedom from runs, sags, overspray, dryspray, pinholes, shadow-through, skips, misses, etc.)

The personnel managing the Contractor's QC Program shall possess a minimum classification as a National Association of Corrosion Engineers (NACE) Coating Inspector Level 2 - Certified, or shall provide evidence of successful inspection of 3 projects of similar or greater complexity and scope that have been completed in the last 2 years. Copies of the certification and/or experience shall be provided. References for experience shall be provided and shall include the name, address, and telephone number of a contact person employed by the bridge owner.

The personnel performing the QC tests shall be trained in coatings inspection and the use of the testing instruments. Documentation of training shall be provided. The QC personnel shall not perform hands on surface preparation or painting activities. Painters shall perform wet film thickness measurements, with QC personnel conducting random spot checks of the wet film. The Contractor shall not replace the QC personnel assigned to the project without advance notice to the Engineer, and acceptance of the replacement(s), by the Engineer.

The Contractor shall supply all necessary equipment to perform the QC inspections. Equipment shall include the following at a minimum:

- Psychrometer or comparable equipment for the measurement of dew point and relative humidity, together with all necessary weather bureau tables or psychrometric charts.
- Surface temperature thermometer
- SSPC Visual Standards VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning; SSPC-VIS 3, Visual Standard for Power and Hand-Tool Cleaned Steel; SSPC-VIS 4, Guide and Reference Photographs for Steel
- Prepared by Water Jetting, and/or SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning, as applicable.
- Commercially available putty knife of a minimum thickness of 40 mils (1mm) and a width between 1 and 3 in. (25 and 75 mm). Note that the putty knife is only required for projects in which the existing coating is being feathered and must be tested with a dull putty knife.
- Testex Press-O-Film Replica Tape and Spring Micrometer
- Bresle Cell Kits or CHLOR*TEST kits for chloride determinations, or equivalent
- Wet Film Thickness Gage
- Blotter paper for compressed air cleanliness checks
- Type 2 Electronic Dry Film Thickness Gage per SSPC - PA2, Measurement of Dry Coating Thickness with magnetic Gages
- Calibration standards for dry film thickness gage

- Light meter for measuring light intensity during paint removal, painting, and inspection activities
- All applicable ASTM and SSPC Standards used for the work (reference list attached)

The instruments shall be calibrated by the Contractor's personnel according to the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection equipment shall be made available to the Engineer for QA observations on an as needed basis.

Hold Point Notification. Specific inspection items throughout this specification are designated as Hold Points. Unless other arrangements are made at the project site, the Contractor shall provide the Engineer with a minimum 4-hour notification before a Hold Point inspection will be reached. If the 4-hour notification is provided and the Work is ready for inspection at that time, the Engineer will conduct the necessary observations. If the Work is not ready at the appointed time, unless other arrangements are made, an additional 4-hour notification is required. Permission to proceed beyond a Hold Point without a QA inspection will be granted solely at the discretion of the Engineer, and only on a case by case basis.

Quality Assurance (QA) Observations. The Engineer will conduct QA observations of any or all phases of the work. The presence or activity of Engineer observations in no way relieves the Contractor of the responsibility to provide all necessary daily QC inspections of his/her own and to comply with all requirements of this Specification.

The Engineer has the right to reject any work that was performed without adequate provision for QA observations.

Inspection Access and Lighting. The Contractor shall facilitate the Engineer's observations as required, including allowing ample time to view the work. The Contractor shall furnish, erect and move scaffolding or other mechanical equipment to permit close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work. Examples of acceptable access structures include:

- Mechanical lifting equipment, such as, scissor trucks, hydraulic booms, etc.
- Platforms suspended from the structure comprised of trusses or other stiff supporting members and including rails and kick boards.
- Simple catenary supports are permitted only if independent life lines for attaching a fall arrest system according to Occupational Safety and Health Administration (OSHA) regulations are provided.

When the surface to be inspected is more than 6 ft. (1.8 m) above the ground or water surface, and fall protection is not provided (e.g., guardrails are not provided), the Contractor shall provide the Engineer with a safety harness and a lifeline according to OSHA regulations. The lifeline and attachment shall not direct the fall into oncoming traffic. The Contractor shall provide a method of attaching the lifeline to the structure independent of the inspection facility or any support of the platform. When the inspection facility (e.g., platform) is more than 2 1/2 ft. (800 mm) above the ground, the Contractor shall provide an approved means of access onto the platform.

The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 30 foot candles (325 LUX). Illumination for cleaning and painting, including the working platforms, access and entryways shall be at least 20 foot candles (215 LUX).

Surface Preparation and Painting Equipment. All cleaning and painting equipment shall include gages capable of accurately measuring fluid and air pressures and shall have valves capable of regulating the flow of air, water or paint as recommended by the equipment manufacturer. The equipment shall be maintained in proper working order.

Diesel or gasoline powered equipment shall be positioned or vented in a manner to prevent deposition of combustion contaminants on any part of the structure.

Hand tools, power tools, pressure washing, water jetting, abrasive blast cleaning equipment, brushes, rollers, and spray equipment shall be of suitable size and capacity to perform the work required by this specification. All power tools shall be equipped with vacuums and High Efficiency Particulate Air (HEPA) filtration. Appropriate filters, traps and dryers shall be provided for the compressed air used for abrasive blast cleaning and conventional spray application. Paint pots shall be equipped with air operated continuous mixing devices unless prohibited by the coating manufacturer.

Test Sections. Prior to surface preparation, the Contractor shall prepare a test section(s) on each structure to be painted in a location(s) which the Engineer considers to be representative of the existing surface condition and steel type for the structure as a whole. More than one test section may be needed to represent the various design configurations of the structure. The purpose of the test section(s) is to demonstrate the use of the tools and degree of cleaning required (cleanliness and profile) for each method of surface preparation that will be used on the project. Each test section shall be approximately 10 sq. ft. (0.93 sq m). The test section(s) shall be prepared using the same equipment, materials and procedures as the production operations. The Contractor shall prepare the test section(s) to the specified level of cleaning according to the appropriate SSPC visual standards, modified as necessary to comply with the requirements of this specification. The written requirements of the specification prevail in the event of a conflict with the SSPC visual standards. Only after the test section(s) have been approved shall the Contractor proceed with surface preparation operations. Additional compensation will not be allowed the Contractor for preparation of the test section(s).

For the production cleaning operations, the specifications and written definitions, the test section(s), and the SSPC visual standards shall be used in that order for determining compliance with the contractual requirements.

Protective Coverings and Damage. All portions of the structure that could be damaged by the surface preparation and painting operations (e.g., utilities), including any sound paint that is allowed to remain according to the contract documents, shall be protected by covering or shielding. Tarpaulins drop cloths, or other approved materials shall be employed. The Contractor shall comply with the provisions of the Illinois Environmental Protection Act. Paint drips, spills, and overspray are not permitted to escape into the air or onto any other surfaces or surrounding property not intended to be painted. Containment shall be used to control paint

drips, spills, and overspray, and shall be dropped and all equipment secured when sustained wind speeds of 40 mph (64 kph) or greater occur, unless the containment design necessitates action at lower wind speeds. The contractor shall evaluate project-specific conditions to determine the specific type and extent of containment needed to control the paint emissions and shall submit a plan for containing or controlling paint debris (droplets, spills, overspray, etc.) to the Engineer for approval prior to starting the work. Approval shall not relieve the Contractor of their ultimate responsibility for controlling paint debris from escaping the work zone.

When the protective coverings need to be attached to the structure, they shall be attached by bolting, clamping, or similar means. Welding or drilling into the structure is prohibited unless approved by the Engineer in writing. When removing coatings containing lead the containment and disposal of the residues shall be as specified in the Special Provision for Containment and Disposal of Lead Paint Cleaning Residues contained elsewhere in this Contract. When removing coatings not containing lead the containment and disposal of the residues shall be as specified in the Special Provision for Containment and Disposal of Non-Lead Paint Cleaning Residues contained elsewhere in this Contract.

The Contractor shall be responsible for any damage caused to persons, vehicles, or property, except as indemnified by the Response Action Contractor Indemnification Act. Whenever the intended purposes of the controls or protective devices used by the Contractor are not being accomplished, as determined by the Engineer, work shall be immediately suspended until corrections are made. Damage to vehicles or property shall be repaired by the Contractor at the Contractor's expense. Painted surfaces damaged by any Contractor's operation shall be repaired, removed and/or repainted, as directed by the Engineer, at the Contractor's expense.

Weather Conditions. Surfaces to be painted after cleaning shall remain free of moisture and other contaminants. The Contractor shall control his/her operations to insure that dust, dirt, or moisture do not come in contact with surfaces cleaned or painted that day.

- a) The surface temperature shall be at least 5°F (3°C) above the dew point during final surface preparation operations. The manufacturers' published literature shall be followed for specific temperature, dew point, and humidity restrictions during the application of each coat.
- b) If the Contractor proposes to control the weather conditions inside containment, proposed methods and equipment for heating and/or dehumidification shall be included in the work plans for the Engineer's consideration. Any heating/dehumidification proposals accepted by the Engineer shall be implemented at no additional cost to the department.
- c) Cleaning and painting shall be done between April 15 and October 31 unless authorized otherwise by the Engineer in writing.

The Contractor shall monitor temperature, dew point, and relative humidity every 4 hours during surface preparation and coating application in the specific areas where the work is being performed. The frequency of monitoring shall increase if weather conditions are changing. If the weather conditions after application and during drying are forecast to be outside the acceptable limits established by the coating manufacturer, coating application shall not proceed.

If the weather conditions are forecast to be borderline relative to the limits established by the manufacturer, monitoring shall continue at a minimum of 4-hour intervals throughout the drying period. The Engineer has the right to reject any work that was performed, or drying that took place, under unfavorable weather conditions. Rejected work shall be removed, recleaned, and repainted at the Contractor's expense.

Compressed Air Cleanliness. Prior to using compressed air for abrasive blast cleaning, blowing down the surfaces, and painting with conventional spray, the Contractor shall verify that the compressed air is free of moisture and oil contamination according to the requirements of ASTM D 4285. The tests shall be conducted at least one time each shift for each compressor system in operation. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air. The Contractor shall also examine the work performed since the last acceptable test for evidence of defects or contamination caused by the compressed air. Effected work shall be repaired at the Contractor's expense.

Low Pressure Water Cleaning and Solvent Cleaning (HOLD POINT). The Contractor shall notify the Engineer 24 hours in advance of beginning surface preparation operations.

- a) Water Cleaning of Lead Containing Coatings Prior to Overcoating. Prior to initiating any mechanical cleaning such as hand/power tool cleaning on surfaces that are painted with lead, all surfaces to be prepared and painted, and the tops of pier and abutment caps shall be washed. Washing is not required if the surfaces will be prepared by water jetting.

Washing shall involve the use of potable water at a minimum of 1000 psi (7 MPa) and less than 5000 psi (34 MPa) according to "Low Pressure Water Cleaning" of SSPCSP12. Paint spray equipment shall not be used to perform the water cleaning. The cleaning shall be performed in such a manner as to remove dust, dirt, chalk, insect and animal nests, bird droppings, loose paint and other foreign matter prior to solvent cleaning. The water, debris, and any loose paint removed by water cleaning shall be collected for proper disposal. The washing shall be completed no more than 2 weeks prior to surface preparation.

If detergents or other additives are added to the water, the detergents/additives shall be included in the submittals and not used until accepted by the Engineer. When detergents or additives are used, the surface shall be rinsed with potable water before the detergent water dries.

After washing has been accepted by the Engineer, all traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants which remain on the steel surfaces to be painted shall be removed by solvent cleaning according to SSPC – SP1, supplemented with scraping (e.g., to remove large deposits of asphaltic cement) as required. The solvent(s) used for cleaning shall be compatible with the existing coating system. The Contractor shall identify the proposed solvent(s) in the submittals. If the existing coating is softened, wrinkled, or shows other signs of attack from the solvents, the Contractor shall immediately discontinue their use. The name and composition of replacement solvents, together with MSDS, shall be submitted for Engineer acceptance prior to use.

Under no circumstances shall subsequent hand/power tool cleaning be performed in areas containing surface contaminants or in areas where the Engineer has not accepted the washing and solvent cleaning. Surfaces prepared by hand/power tool cleaning without approval of the washing and solvent cleaning may be rejected by the Engineer. Rejected surfaces shall be re-cleaned with both solvent and the specified mechanical means at the Contractor's expense.

After all washing and mechanical cleaning are completed, representative areas of the existing coating shall be tested to verify that the surface is free of chalk and other loose surface debris or foreign matter. The testing shall be performed according to ASTM D4214. Cleaning shall continue until a chalk rating of 6 or better is achieved in every case.

- b) Water Cleaning of Non-Lead Coatings Prior to Overcoating. Thoroughly clean the surfaces according to the steps defined above for "Water Cleaning of Lead Containing Coatings Prior to Overcoating," except that the wash water does not need to be collected, and if the shop primer is inorganic zinc, the chalk rating does not apply. All other provisions are applicable.
- c) Water Cleaning/Debris Removal Prior to Total Coating Removal. When total coating removal is specified, water cleaning of the surface prior to coating removal is not required by this specification and is at the option of the Contractor. If the Contractor chooses to use water cleaning, and the existing coating contains lead, all water and debris shall be collected for proper disposal.

Whether or not the surfaces are pre-cleaned using water, the tops of the pier caps and abutments shall be cleaned free of dirt, paint chips, insect and animal nests, bird droppings and other foreign matter and the debris collected for proper disposal.

Prior to mechanical cleaning, oil, grease, and other soluble contaminants on bare steel or rusted surfaces shall be removed by solvent cleaning according to SSPC-SP1.

- d) Water Cleaning Between Coats. When foreign matter has accumulated on a newly applied coat, washing shall be performed prior to the application of subsequent coats. The water does not need to be collected unless it contacts existing lead containing coatings.

Laminar and Stratified Rust. All laminar and stratified rust that has formed on the existing steel surfaces shall be removed. Pack rust formed along the perimeter of mating surfaces of connected plates or shapes of structural steel shall be removed to the extent feasible without mechanically detaching the mating surface. Any pack rust remaining after cleaning the mating surfaces shall be tight and intact when examined using a dull putty knife. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges, the work shall be suspended, and the damaged areas repaired to the satisfaction of the Engineer, at the Contractor's expense. The Contractor shall also demonstrate that he/she has made the necessary adjustments to prevent a reoccurrence of the damage prior to resuming work.

Surface Preparation (HOLD POINT). One or more of the following methods of surface preparation shall be used as specified on the plans. When a method of surface preparation is specified, it applies to the entire surface, including areas that may be concealed by the containment connection points. In each case, as part of the surface preparation process, soluble salts shall be remediated as specified under "Soluble Salt Remediation". The Contractor shall also note that the surface of the steel beneath the existing coating system may contain corrosion and/or mill scale. Removal of said corrosion and/or mill scale, when specified, shall be considered included in this work and no extra compensation will be allowed.

When a particular cleaning method is specified for use in distinct zones on the bridge, the cleaning shall extend into the existing surrounding paint until a sound border is achieved. The edge of the existing paint is considered to be sound and intact if it can not be lifted by probing the edge with a dull putty knife. The sound paint shall be feathered for a minimum of 1 1/2 in. (40 mm) to achieve a smooth transition between the prepared steel and the existing coatings. Sanders with vacuum attachments, which have been approved by the Engineer, shall be used as necessary to accomplish the feathering.

- a) Limited Access Areas: A best effort with the specified methods of cleaning shall be performed in limited access areas such as the backsides of rivets inside built up box members. The equipment being used for the majority of the cleaning may need to be supplemented with other commercially available equipment, such as angle nozzles, to properly clean the limited access areas. The acceptability of the best effort cleaning in these areas is at the sole discretion of the Engineer.
- b) Near White Metal Blast Cleaning: This surface preparation shall be accomplished according to the requirements of Near White Metal Blast Cleaning SSPC-SP 10. The designated surfaces shall be prepared by dry abrasive blast cleaning, wet abrasive blast cleaning, or water jetting with abrasive injection. A Near White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining.

Random staining shall be limited to no more than 5 percent of each 9 sq. in. (58 sq. cm) of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. With the exception of crevices as defined below, surface discoloration is considered to be a residue that must be removed, rather than a stain, if it possesses enough mass or thickness that it can be removed as a powder or in chips when scraped with a pocketknife.

A surface profile shall be created on the steel as defined later under "Surface Profile."

At the discretion of the Engineer, after a best effort cleaning, slight traces of existing coating may be permitted to remain within crevices such as those created between rivets, bolts, and plates, and the underlying steel. When traces of coating are permitted to remain, the coating shall be tightly bonded when examined by probing with a dull putty knife. The traces of coating shall be confined to the bottom portion of the crevices only, and shall not extend onto the surrounding steel or plate or onto the outer surface of the rivets or bolts. Pitted steel is excluded from exemption considerations and shall be cleaned according to SSPC-SP10.

If hackles or slivers are visible on the steel surface after cleaning, the Contractor shall remove them by grinding followed by reblast cleaning. At the discretion of the Engineer, the use of power tools to clean the localized areas after grinding, and to establish a surface profile acceptable to the coating manufacturer, can be used in lieu of blast cleaning.

If the surfaces are prepared using wet abrasive methods, attention shall be paid to tightly configured areas to assure that the preparation is thorough. After surface preparation is completed, the surfaces, surrounding steel, and containment materials/scaffolding shall be rinsed to remove abrasive dust and debris. Potable water shall be used for all operations. An inhibitor may be added to the supply water and/or rinse water to prevent flash rusting. If a rust inhibitor is proposed, the Contractor shall provide a sample of the proposed inhibitor together with a letter from the coating manufacturer indicating that the inhibitor is suitable for use with their products. The surfaces shall be allowed to completely dry before the application of any coating.

- c) Commercial Grade Power Tool Cleaning: This surface preparation shall be accomplished according to the requirements of Commercial Grade Power Tool Cleaning, SSPC-SP15. The designated surfaces shall be completely cleaned with power tools. A Commercial Grade Power Tool Cleaned surface, when viewed without magnification, is free of all visible oil, grease, dirt, rust, coating, oxides, mill scale, corrosion products, and other foreign matter, except for staining. In previously pitted areas, slight residues of rust and paint may also be left in the bottoms of pits.

Random staining shall be limited to no more than 33 percent of each 9 sq. in. (58 sq. cm) of surface area. Allowable staining may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Surface discoloration is considered to be a residue that must be removed, rather than a stain, if it possesses enough mass or thickness that it can be removed as a powder or in chips when scraped with a pocketknife.

A surface profile shall be created on the steel as defined later under "Surface Profile."

At the Contractor's option, Near White Metal Blast Cleaning may be substituted for Power Tool Cleaning – Commercial Grade, as long as containment systems appropriate for abrasive blast cleaning are utilized and there is no additional cost to the Department.

- d) Power Tool Cleaning – Modified SP3: This surface preparation shall be accomplished according to the requirements of SSPC-SP3, Power Tool Cleaning except as modified as follows. The designated surfaces shall be cleaned with power tools. A power tool cleaned surface shall be free of all loose rust, loose mill scale, loose and peeling paint, and loose rust that is bleeding through and/or penetrating the coating. All locations of visible corrosion and rust bleed, exposed or lifting mill scale, and lifting or loose paint shall be prepared using the power tools.

Upon completion of the cleaning, rust, rust bleed, mill scale and surrounding paint are permitted to remain if they can not be lifted using a dull putty knife.

Power Tool Cleaning of Shop Primed Steel. When steel coated with only a prime coat of inorganic or organic zinc is specified to be cleaned, this work shall be accomplished as follows. After cleaning the surface as specified under "Water Cleaning of Non-Lead Coatings Prior to Overcoating," damaged and rusted areas shall be spot cleaned according Power Tool Cleaning -Modified SSPC-SP3. The edges of the coating surrounding the spot repairs shall be feathered.

Abrasives. When abrasive blast cleaning is specified, it shall be performed using either expendable abrasives (other than silica sand) or recyclable steel grit abrasives. Expendable abrasives shall be used one time and disposed of. Abrasive suppliers shall certify that the expendable abrasives meet the requirements of SSPC-AB1 and that recyclable steel grit abrasives meet AB3. On a daily basis, the Contractor shall verify that recycled abrasives are free of oil contamination by conducting oil content tests according to SSPC-AB2.

All surfaces prepared with abrasives not meeting the SSPC-AB1, AB2, or AB3 requirements, as applicable, shall be solvent cleaned or low pressure water cleaned as directed by the Engineer, and reblast cleaned at the Contractor's expense.

Surface Profile (HOLD POINT). The abrasives used for blast cleaning shall have a gradation such that the abrasive will produce a uniform surface profile of 1.5 to 4.5 mils (38 to 114 microns). If the profile requirements of the coating manufacturer are more restrictive, advise the Engineer and comply with the more restrictive requirements. For recycled abrasives, an appropriate operating mix shall be maintained in order to control the profile within these limits.

The surface profile for the Power Tool Cleaning - Commercial Grade shall be within the range specified by the coating manufacturer, but not less than 2.0 mils (50 microns).

The surface profile produced by the Contractor's surface preparation procedures shall be determined by replica tape and spring micrometer at the beginning of the work, and each day that surface preparation is performed. Areas having unacceptable measurements shall be further tested to determine the limits of the deficient area. The replica tape shall be attached to the daily report.

When unacceptable profiles are produced, work shall be suspended. The Contractor shall submit a plan for the necessary adjustments to insure that the correct surface profile is achieved on all surfaces. The Contractor shall not resume work until the new profile is verified by the QA observations, and the Engineer confirms, in writing, that the profile is acceptable.

Soluble Salt Remediation (HOLD POINT). The Contractor shall implement surface preparation procedures and processes that will remove chloride from the surfaces. Surfaces that may be contaminated with chloride include, but are not limited to, expansion joints and all areas that are subject to roadway splash or run off such as fascia beams and stringers.

Methods of chloride removal may include, but are not limited to, steam cleaning or pressure washing with or without the addition of a chemical soluble salt remover as approved by the coating manufacturer, and scrubbing before or after initial paint removal. The Contractor may also elect to clean the steel and allow it to rust overnight followed by recleaning, or by utilizing blends of fine and coarse abrasives during blast cleaning, wet abrasive/water jetting methods of preparation, or combinations of the above. If steam or water cleaning methods of chloride removal are utilized over surfaces where the coating has been completely removed, and the water does not contact any lead containing coatings, the water does not have to be collected.

The Contractor shall provide the proposed procedures for chloride remediation in the Surface Preparation/Painting Plan.

Upon completion of the chloride remediation steps, the Contractor shall use cell methods of field chloride extraction and test procedures (e.g., silver dichromate) accepted by the Engineer, to test representative surfaces that were previously rusted (e.g., pitted steel) for the presence of remaining chlorides. Remaining chloride levels shall be no greater than $7\mu\text{g}/\text{sq cm}$ as read directly from the surface without any multiplier applied to the results. The testing must be performed, and the results must be acceptable, prior to painting each day.

A minimum of 5 tests per 1000 sq. ft. (93 sq m) or fraction thereof completed in a given day, shall be conducted at project start up. If results greater than $7\mu\text{g}/\text{sq cm}$ are detected, the surfaces shall be recleaned and retested at the same frequency. If acceptable results are achieved on three consecutive days in which testing is conducted, the test frequency may be reduced to 1 test per 1000 sq. ft. (93 sq. m) prepared each day provided the chloride remediation process remains unchanged. If unacceptable results are encountered, or the methods of chloride remediation are changed, the Contractor shall resume testing at a frequency of 5 tests per 1000 sq. ft. (93 sq. m).

Following successful chloride testing the chloride test areas shall be cleaned. Commercial Grade Power Tool Cleaning can be used to clean the test locations when the specified degree of cleaning is SSPC-SP10.

Surface Condition Prior to Painting (HOLD POINT). Prepared surfaces, shall meet the requirements of the respective degrees of cleaning immediately prior to painting, and shall be painted before rusting appears on the surface. If rust appears or bare steel remains unpainted for more than 12 hours, the affected area shall be prepared again at the expense of the Contractor.

All loose paint and surface preparation cleaning residue on bridge steel surfaces, scaffolding and platforms, containment materials, and tops of abutments and pier caps shall be removed prior to painting. When lead paint is being disturbed, cleaning shall be accomplished by HEPA vacuuming unless it is conducted within a containment that is designed with a ventilation system capable of collecting the airborne dust and debris created by sweeping and blowing with compressed air.

The quality of surface preparation and cleaning of surface dust and debris must be accepted by the Engineer prior to painting. The Engineer has the right to reject any work that was performed without adequate provision for QA observations to accept the degree of cleaning. Rejected coating work shall be removed and replaced at the Contractor's expense.

General Paint Requirements. Paint storage, mixing, and application shall be accomplished according to these specifications and as specified in the paint manufacturer's written instructions and product data sheets for the paint system used. In the event of a conflict between these specifications and the coating manufacturers' instructions and data sheets, 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.

Unless noted otherwise, If a new concrete deck or repair to an existing deck is required, painting shall be done after the deck is placed and the forms have been removed.

- a) **Paint Storage and Mixing.** All Paint shall be stored according to the manufacturer's published instructions, including handling, temperatures, and warming as required prior to mixing. All coatings shall be supplied in sealed containers bearing the manufacturer's name, product designation, batch number and mixing/thinning instructions. Leaking containers shall not be used.

Mixing shall be according to the manufacturer's instructions. Thinning shall be performed using thinner provided by the manufacturer, and only to the extent allowed by the manufacturer's written instructions. In no case shall thinning be permitted that would cause the coating to exceed the local Volatile Organic Compound (VOC) emission restrictions. For multiple component paints, only complete kits shall be mixed and used. Partial mixing is not allowed.

The ingredients in the containers of paint shall be thoroughly mixed by mechanical power mixers according to the manufacturer's instructions, in the original containers before use or mixing with other containers of paint. The paint shall be mixed in a manner that will break up all lumps, completely disperse pigment and result in a uniform composition. Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains on the bottom of the container. Excessive skinning or partial hardening due to improper or prolonged storage will be cause for rejection of the paint, even though it may have been previously inspected and accepted.

Multiple component coatings shall be discarded after the expiration of the pot life. Single component paint shall not remain in spray pots, painters buckets, etc. overnight. It shall be stored in a covered container and remixed before use.

The Engineer reserves the right to sample field paint (individual components and/or the mixed material) and have it analyzed. If the paint does not meet the product requirements due to excessive thinning or because of other field problems, the coating shall be removed from that section of the structure and replaced as directed by the Engineer.

- b) **Application Methods.** Unless prohibited by the coating manufacturer's written instructions, paint may be applied by spray methods, rollers, or brushes. If applied with conventional or airless spray methods, paint shall be applied in a uniform layer with overlapping at the edges of the spray pattern.

The painters shall monitor the wet film thickness of each coat during application. The wet film thickness shall be calculated based on the solids by volume of the material and the amount of thinner added. When the new coating is applied over an existing system, routine QC inspections of the wet film thickness shall be performed in addition to the painter's checks in order to establish that a proper film build is being applied.

When brushes or rollers are used to apply the coating, additional applications may be required to achieve the specified thickness per layer.

- c) **Painting Shop Primed Steel.** After cleaning, rusted and damaged areas shall be touched up using the same primer specified for painting the existing structure. The intermediate and finish coats specified for painting the existing structure shall be applied to the steel.

When inorganic zinc has been used as the shop primer, a mist coat of the intermediate coat shall be applied first in order to prevent pinholing and bubbling.

- d) Recoating and Film Continuity (HOLD POINT for each coat). Paint shall be considered dry for recoating according to the time/temperature/humidity criteria provided in the manufacturer's instructions and when an additional coat can be applied without the development of film irregularities; such as lifting, wrinkling, or loss of adhesion of the under coat. If surfaces are contaminated, washing shall be accomplished prior to intermediate and final coats. Wash water does not have to be collected unless the water contacts existing lead containing coatings.

Painting shall be done in a neat and workmanlike manner. Each coat of paint shall be applied as a continuous film of uniform thickness free of defects including, but not limited to, runs, sags, overspray, dryspray, pinholes, voids, skips, misses, and shadow-through. Defects such as runs and sags shall be brushed out immediately during application.

Paint Systems. The paint system(s) from the list below shall be applied as specified.

The paint manufacturer's relative humidity, dew point, and material, surface, and ambient temperature restrictions shall be provided with the submittals and shall be strictly followed. Written recommendations from the paint manufacturer for the length of time each coat must be protected from cold or inclement weather (e.g., exposure to rain), during the drying period shall be included in the submittals. Upon acceptance by the Engineer, these times shall be used to govern the duration that protection must be maintained during drying.

Where stripe coats are indicated, the Contractor shall apply an additional coat to edges, rivets, bolts, crevices, welds, and similar surface irregularities. The stripe coat shall be applied by brush and/or spray to thoroughly work the coating into or on the irregular surfaces, and shall extend onto the surrounding steel a minimum of 1 in. (25 mm) in all directions. The purpose of the stripe coat is to build additional thickness and to assure complete coverage of these areas.

The stripe coat may be applied as part of the application of the full coat unless prohibited by the coating manufacturer. If applied as part of the application process of the full coat, the stripe coat shall be allowed to dry for a minimum of 10 minutes in order to allow Contractor QC personnel to verify that the coat was applied. If a wet-on-wet stripe coat is prohibited by the coating manufacturer or brush or roller application of the full coat pulls the underlying stripe coat, the stripe coat shall dry according to the manufacturers' recommended drying times prior to the application of the full coat. In the case of the prime coat, the full coat can also be applied first to protect the steel, followed by the stripe coat after the full coat has dried.

- a) System 1 – OZ/E/U – for Bare Steel: System 1 shall consist of the application of a full coat of organic (epoxy) zinc-rich primer, a full intermediate coat of epoxy, and a full finish coat of aliphatic urethane. Stripe coats of the prime and finish coats shall be applied. The film thicknesses of the full coats shall be as follows, measured according to SSPC-PA2:
- One full coat of organic zinc-rich primer between 3.5 and 5.0 mils (90 and 125 microns) dry film thickness. The prime coat shall be tinted to a color that contrasts with the steel surface.

- One full intermediate coat of epoxy between 3.0 and 6.0 mils (75 and 150 microns) dry film thickness. The intermediate coat shall be a contrasting color to both the first coat and finish coat.
- One full finish coat of aliphatic urethane between 2.5 and 4.0 mils (65 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 9.0 and 15.0 mils (225 and 375 microns).

- b) System 2 – PS/EM/U – for Overcoating an Existing System: System 2 shall consist of the application of a full coat of epoxy penetrating sealer, a spot intermediate coat of aluminum epoxy mastic and a stripe and full finish coat of aliphatic urethane.

A full coat of epoxy penetrating sealer shall be applied to all surfaces following surface preparation. A spot intermediate coat shall consist of the application of one coat of the aluminum epoxy mastic on all areas where rust is evident and areas where the old paint has been removed, feathered and/or damaged prior to, during or after the cleaning and surface preparation operations. After the spot intermediate, a stripe coat and full finish coat of aliphatic urethane shall be applied. The film thicknesses shall be as follows, measured according to SSPC-PA2:

- One full coat of epoxy penetrating sealer between 1.0 and 2.0 mils (25 and 50 microns) dry film thickness.
- One spot coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The color shall contrast with the finish coat.
- One full finish coat of aliphatic urethane between 2.5 and 4.0 mils (65 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of the stripe coat, shall be between 8.5 and 13.0 mils (215 and 325 microns). The existing coating thickness to remain under the overcoat must be verified in order to obtain accurate total dry film thickness measurements.

- c) System 3 – EM/EM/AC – for Bare Steel: System 3 shall consist of the application of two full coats of aluminum epoxy mastic and a full finish coat of waterborne acrylic. Stripe coats for first coat of epoxy mastic and the finish coat shall be applied. The film thicknesses of the full coats shall be as follows, measured according to SSPC-PA2:

- One full coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The first coat of aluminum epoxy mastic shall be tinted a contrasting color with the blast cleaned surface and the second coat.
- One full intermediate coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The intermediate coat shall be a contrasting color to the first coat and the finish coat.
- A full finish coat of waterborne acrylic between 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 12.0 and 18.0 mils (360 and 450 microns).

- d) System 4 – PS/EM/AC – for Overcoating an Existing System: System 4 shall consist of the application of a full coat of epoxy penetrating sealer, a spot intermediate coat of aluminum epoxy mastic and a stripe and full finish coat of waterborne acrylic.

A full coat of epoxy penetrating sealer shall be applied to all surfaces following surface preparation. A spot intermediate coat shall consist of the application of one coat of the aluminum epoxy mastic on all areas where rust is evident and areas where the old paint has been removed, feathered and/or damaged prior to, during or after the cleaning and surface preparation operations. After the spot intermediate, a stripe coat and full finish coat of waterborne acrylic shall be applied. The film thicknesses shall be as follows, measured according to SSPC-PA2:

- One full coat of epoxy penetrating sealer between 1.0 and 2.0 mils (25 and 50 microns) dry film thickness.
- One spot coat of aluminum epoxy mastic between 5.0 and 7.0 mils (125 and 175 microns) dry film thickness. The color shall contrast with the finish coat.
- One full finish coat of waterborne acrylic between 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of the stripe coat, shall be between 8.0 and 13.0 mils (200 and 325 microns). The existing coating thickness to remain under the overcoat must be verified in order to obtain accurate total dry film thickness measurements.

- e) System 5 – MCU – for Bare Steel: System 5 shall consist of the application of a full coat of moisture cure urethane (MCU) zinc primer, a full coat of MCU intermediate, and a full coat of MCU finish. Stripe coats of the prime and finish coats shall be applied. The contractor shall comply with the manufacturer's requirements for drying times between the application of the stripe coats and the full coats. The film thicknesses of the full coats shall be as follows, measured according to SSPC-PA2:

- One full coat of MCU zinc primer between 3.0 and 5.0 mils (75 and 125 microns) dry film thickness. The prime coat shall be tinted to a color that contrasts with the steel surface.
- One full MCU intermediate coat between 3.0 and 4.0 mils (75 and 100 microns) dry film thickness. The intermediate coat shall be a contrasting color to both the first coat and finish coat.
- One full MCU finish coat between 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 8.0 and 13.0 mils (200 and 325 microns).

- f) System 6 – MCU – for Overcoating an Existing System: System 6 shall consist of the application of a full coat of moisture cure urethane (MCU) penetrating sealer, a spot coat of MCU intermediate, and a stripe and full coat of MCU finish.

A full coat of MCU penetrating sealer shall be applied to all surfaces following surface preparation. A spot intermediate coat shall consist of the application of one coat of MCU intermediate on all areas where rust is evident and areas where the old paint has been removed, feathered and/or damaged prior to, during or after the cleaning and surface preparation operations. After the spot intermediate, a stripe coat and full coat of MCU finish shall be applied. The contractor shall comply with the manufacturer's requirements for drying time between the application of the stripe coat and the full finish coat. The film thicknesses shall be as follows, measured according to SSPC-PA2:

- One full coat of MCU sealer between 1.0 and 2.0 mils (25 and 50 microns) dry film thickness.
- One full MCU intermediate coat between 3.0 and 4.0 mils (75 and 100 microns) dry film thickness. The color shall contrast with the finish coat.
- One full MCU finish coat 2.0 and 4.0 mils (50 and 100 microns) dry film thickness. Finish coat color shall be according to contract plans.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 6.0 and 10.0 mils (150 and 250 microns). The existing coating thickness to remain under the overcoat must be verified in order to obtain accurate total dry film thickness measurements.

Repair of Damage to New Coating System and Areas Concealed by Containment. The Contractor shall repair all damage to the newly installed coating system and areas concealed by the containment/protective covering attachment points, at no cost to the Department. If the damage extends to the substrate and the original preparation involved abrasive blast cleaning, the damaged areas shall be prepared to Power Tool Cleaning - Commercial Grade. If the original preparation was other than blast cleaning or the damage does not extend to the substrate, the loose, fractured paint shall be cleaned to Power Tool Cleaning – Modified SP3. The surrounding coating at each repair location shall be feathered for a minimum distance of 1 1/2 in. (40 mm) to achieve a smooth transition between the prepared areas and the existing coating. If the bare steel is exposed, all coats shall be applied to the prepared area. If only the intermediate and finish coats are damaged, the intermediate and finish shall be applied. If only the finish coat is damaged, the finish shall be applied.

Special Instructions.

- a) At the completion of the work, the Contractor shall stencil the painting date and the paint code on the bridge. The letters shall be capitals, not less than 2 in. (50 mm) and not more than 3 in. (75 mm) in height.

The stencil shall contain the following wording "PAINTED BY (insert the name of the Contractor)" and shall show the month and year in which the painting was completed, followed by the appropriate code for the coating material applied, all stenciled on successive lines:

CODE U (for field applied System 3 or System 4).

CODE Z (for field applied System 1 or System 2).

CODE AA (for field applied System 5 or System 6).

This information shall be stenciled on the cover plate of a truss end post near the top of the railing, or on the outside face of an outside stringer near one end of the bridge, or at some equally visible surface near the end of the bridge, as designated by the Engineer.

b) All surfaces painted inadvertently shall be cleaned immediately.

It is understood and agreed that the cost of all work outlined above, unless otherwise specified, has been included in the bid, and no extra compensation will be allowed.

Basis of Payment. This work shall be paid for at the contract Lump Sum price for CLEANING AND PAINTING STEEL BRIDGE, at the designated location, or for CLEANING AND PAINTING the structure or portions thereof described. Payment will not be authorized until all requirements for surface preparation and painting have been fulfilled as described in this specification, including the preparation and submittal of all QC documentation. Payment will also not be authorized for non-conforming work until the discrepancy is resolved in writing.

Appendix 1 – Reference List

The Contractor shall maintain the following regulations and references on site for the duration of the project:

- Illinois Environmental Protection Act
- ASTM D 4214, Standard Test Method for Evaluating Degree of Chalking of Exterior Paint Films
- ASTM D 4285, Standard Test Method for Indicating Oil or Water in Compressed Air
- SSPC-AB 1, Mineral and Slag Abrasives
- SSPC-AB 2, Specification for Cleanliness of Recycled Ferrous Metallic Abrasives
- SSPC-AB 3, Newly Manufactured or Re-Manufactured Steel Abrasives
- SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages
- SSPC-QP 1, Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Structures)
- SSPC-QP 2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint
- SSPC-SP 1, Solvent Cleaning
- SSPC-SP 3, Power Tool Cleaning
- SSPC-SP 10/NACE No. 2, Near White Metal Blast Cleaning
- SSPC-SP 12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
- SSPC-SP15, Commercial Grade Power Tool Cleaning
- SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
- SSPC-VIS 3, Visual Standard for Power- and Hand-Tool Cleaned Steel
- SSPC-VIS 4, Guide and Reference Photographs for Steel Cleaned by Water Jetting
- SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning
- The paint manufacturer's application instructions, MSDS and product data sheets

CONTAINMENT AND DISPOSAL OF LEAD PAINT CLEANING RESIDUES

Effective: October 2, 2001

Revised: March 6, 2009

Description. This work shall consist of the containment, collection, temporary storage, transportation and disposal of waste from lead paint removal projects. Waste requiring containment and control includes, but is not limited to, old paint, spent abrasives, corrosion products, mill scale, dirt, dust, grease, oil, salts, and water used for cleaning the surface of existing lead coatings prior to overcoating.

General. The existing coatings contain lead and may also contain other toxic metals. This specification provides the requirements for containment and for the protection of the public, and the environment from exposure to harmful levels of toxic metals that may be present in the paint being removed or repaired. The Contractor shall take reasonable and appropriate precautions to protect the public from the inhalation or ingestion of dust or debris from the operations, and is responsible for the clean-up of all spills of waste at no additional cost to the Department.

The Contractor shall comply with the requirements of this Specification and all applicable Federal, State, and Local laws, codes, and regulations, including, but not limited to the regulations of the United States Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), and Illinois Environmental Protection Agency (IEPA). The Contractor shall comply with all applicable regulations even if the regulation is not specifically referenced herein. If a Federal, State, or Local regulation is more restrictive than the requirements of this Specification, the more restrictive requirements shall prevail.

Submittals. The Contractor shall submit for Engineer review and acceptance, the following drawings and plans for accomplishing the work. The submittals shall be provided within 30 days of execution of the contract unless given written permission by the Engineer to submit them at a later date. Work cannot proceed until the submittals are accepted by the Engineer. Details for each of the plans are presented within the body of this specification. The Contractor shall also maintain on site, copies of the standards and regulations referenced herein (list provided in appendix 1).

- a) Containment Plans. The containment plans shall include drawings, equipment specifications, and calculations (wind load, air flow and ventilation when negative pressure is specified). The plans shall include copies of the manufacturer's specifications for the containment materials and equipment that will be used to accomplish containment and ventilation.

When required by the contract plans, the submittal shall provide calculations that assure the structural integrity of the bridge when it supports the containment and the calculations and drawings shall be signed and sealed by a Structural Engineer licensed in the state of Illinois.

When working over the railroad or navigable waterways, the Department will notify the respective agencies that work is being planned. Unless otherwise directed by the Engineer, the Contractor is responsible for follow up contact, and shall provide evidence that the railroad, Coast Guard, Corps of Engineers, and other applicable agencies are satisfied with the clearance provided and other safety measures that are proposed.

- b) Environmental Monitoring Plan. The Environmental Monitoring Plan shall address the visual inspections and clean up of the soil and water that the Contractor will perform, including final project inspection and cleanup. The plan shall address the daily visible emissions observations that will be performed and the corrective action that will be implemented in the event emissions or releases occur. Provisions for high volume ambient air monitoring, the Quality Assurance (QA) monitoring plan, laboratory analysis and reporting shall be provided together with the name and qualifications of the laboratory that is proposed for Total Suspended Particulate (TSP)-lead analysis.
- c) Waste Management Plan. The Waste Management Plan shall address all aspects of waste handling, storage, testing, hauling and disposal. Include the names, addresses, and a contact person for the proposed licensed waste haulers and disposal facilities. Submit the name and qualifications of the laboratory proposed for Toxicity Characteristic Leaching Procedure (TCLP) analysis. If the use of abrasive additives is proposed, provide the name of the additive, the premixed ratio of additive to abrasive being provided by the supplier, and a letter from the supplier of the additive indicating IEPA acceptance of the material. Note that the use of any steel or iron based material, such as but not limited to grit, shot, fines, or filings as an abrasive additive is prohibited.
- d) Contingency Plan. The Contractor shall prepare a contingency plan for emergencies including fire, accident, failure of power, failure of dust collection system, failure of supplied air system or any other event that may require modification of standard operating procedures during lead removal. The plan shall include specific procedures to ensure safe egress and proper medical attention in the event of an emergency.

When the Engineer accepts the submittals, the Contractor will receive written notification. The Contractor shall not begin any work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance of the plans does not relieve the Contractor from the responsibility to conduct the work according to the requirements of Federal, State, or Local regulations, this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Quality Control (QC) Inspections. The Contractor shall perform first line, in process QC inspections of all environmental control and waste handling aspects of the project to verify compliance with these specification requirements and the accepted drawings and plans. The Contractor shall use the IDOT Environmental Daily Report form supplied by the Engineer to record the results of the inspections. The completed reports shall be turned into the Engineer before work resumes the following day. Contractor QC inspections shall include, but not be limited to the following:

Proper installation and continued performance of the containment system(s) in accordance with the approved drawings.

Visual inspections of emissions into the air and verification that the cause(s) for any unacceptable emissions is corrected.

Set up, calibration, operation, and maintenance of the regulated area and high volume ambient air monitoring equipment, including proper shipment of cassettes/filters to the laboratory for analysis. Included is verification that the Engineer receives the results within the time frames specified and that appropriate steps are taken to correct work practices or containment in the event of unacceptable results.

Visual inspections of spills or deposits of contaminated materials into the water or onto the ground, pavement, soil, or slope protection. Included is verification that proper cleanup is undertaken and that the cause(s) of unacceptable releases is corrected.

Proper implementation of the waste management plan including laboratory analysis and providing the results to the Engineer within the time frames specified herein.

Proper implementation of the contingency plans for emergencies.

The personnel providing the QC inspections shall possess current SSPC-C3 certification or equal, including the annual training necessary to maintain that certification (SSPC-C5 or equal), and shall provide evidence of successful completion of 2 projects of similar or greater complexity and scope that have been completed in the last 2 years. References shall include the name, address, and telephone number of a contact person employed by the bridge owner. Proof of initial certification and the current annual training shall also be provided.

Quality Assurance (QA) Observations. The Engineer will conduct QA observations of any or all of the QC monitoring inspections that are undertaken. The presence or activity of Engineer observations in no way relieves the Contractor of the responsibility to provide all necessary daily QC inspections of its own and to comply with all requirements of this Specification.

Containment Requirements. The Contractor shall install and maintain containment systems surrounding the work for the purpose of controlling emissions of dust and debris according to the requirements of this specification. Working platforms and containment materials that are used shall be firm and stable and platforms shall be designed to support the workers, inspectors, spent surface preparation media (e.g., abrasives), and equipment during all phases of surface preparation and painting. Platforms, cables, and other supporting structures shall be designed according to OSHA regulations. If the containment needs to be attached to the structure, the containment shall be attached by bolting, clamping, or similar means. Welding or drilling into the structure is prohibited unless approved by the Engineer in writing.

The containment shall be dropped in the event of sustained winds of 40 mph (64 kph) or greater and all materials and equipment secured.

The Contractor shall provide drawings showing the containment system and indicating the method(s) of supporting the working platforms and containment materials to each other and to the bridge. When the use of negative pressure and airflow inside containment is specified, the Contractor shall provide all ventilation calculations and details on the equipment that will be used for achieving the specified airflow and dust collection.

When directed in the contract plans, the Contractor shall submit calculations and drawings, signed and sealed by a Structural Engineer licensed in the state of Illinois, that assure the structural integrity of the bridge under the live and dead loads imposed, including the design wind loading.

When working over railroads, the Contractor shall provide evidence that the proposed clearance and the safety provisions that will be in place (e.g., flagman) are acceptable to the railroad. In the case of work over navigable waters, the Contractor shall provide evidence that the proposed clearance and provisions for installing or moving the containment out of navigation lanes is acceptable to authorities such as the Coast Guard and Army Corps of Engineers. The Contractor shall include plans for assuring that navigation lighting is not obscured, or if it is obscured, that temporary lighting is acceptable to the appropriate authorities (e.g., Coast Guard) and will be utilized.

Engineer review and acceptance of the drawings and calculations shall not relieve the Contractor from the responsibility for the safety of the working platforms and containment, and for providing ample ventilation to control worker and environmental exposures. After the work platforms and containment materials are erected additional measures may be needed to ensure worker safety according to OSHA regulations. The Contractor shall institute such measures at no additional cost to the Department.

Containment for the cleaning operation of this contract is defined as follows:

The containment system shall maintain the work area free of visible emissions of dust and debris according to all provisions of this Specification, with no debris permitted outside of the regulated area at any time. All debris within the regulated area and within the containment shall be collected at the end of the last shift each day, and properly stored in sealed containers. Cleaning shall be accomplished by HEPA vacuuming unless it is conducted within a containment that is designed with a ventilation system capable of collecting the airborne dust and debris created by sweeping and blowing with compressed air. The ventilation system shall be in operation during the cleaning.

The containment systems shall comply with the specified SSPC Guide 6 classifications as presented in Table 1 for the method of paint removal utilized.

TSP-lead in the air at monitoring locations selected by the Engineer shall comply with the requirements specified herein.

The Contractor shall take appropriate action to avoid personnel injury or damage to the structure from the installation and use of the containment system. If the Engineer determines that there is the potential for structural damage caused by the installed containment system, the Contractor shall take appropriate action to correct the situation.

In addition to complying with the specific containment requirements in Table 1 for each method of removal, the Contractor shall provide and maintain coverage over the ground in the areas to be cleaned. This coverage shall be capable of catching and containing surface preparation media, paint chips, and paint dust in the event of an accidental escape from the primary containment. The containment materials shall be cleaned of loose material prior to relocation or dismantling. Acceptable methods of cleaning include blowing down the surfaces with compressed air while the ventilation system is in operation, HEPA vacuuming, and/or wet wiping. If paint chips or dust is observed escaping from the containment materials during moving, all associated operations shall be halted and the materials and components recleaned.

The containment systems shall also meet the following requirements:

a) Dry Abrasive Blast Cleaning - Full Containment with Negative Pressure (SSPC Class 1A)

The enclosure shall be designed, installed, and maintained to sustain maximum anticipated wind forces, including negative pressure. Flapping edges of containment materials are prohibited and the integrity of all containment materials, seams, and seals shall be maintained for the duration of the project. Airflow inside containment shall be designed to provide visibility and reduce worker exposures to toxic metals according to OSHA regulations and as specified in Table 1 and its accompanying text. When the location of the work on the bridge, or over lane closures permit, the blast enclosure shall extend a minimum of 3 ft. (1 m) beyond the limits of surface preparation to allow the workers to blast away from, rather than into the seam between the containment and the structure. The blast enclosure shall have an entrance chamber to allow entrance and exit from the enclosure without allowing the escape of blasting residue.

If recyclable metallic abrasives are used, the Contractor shall operate the equipment in a manner that minimizes waste generation. Steps shall also be taken to minimize dust generation during the transfer of all abrasive/paint debris (expendable or recyclable abrasives) for recycling or disposal. Acceptable methods include, but are not limited to vacuuming, screw or belt conveyance systems, or manual conveyance. However manual conveyance is only permitted if the work is performed inside a containment that is equipped with an operating ventilation system capable of controlling the dust that is generated.

Appropriate filtration shall be used on the exhaust air of dust collection and abrasive recycling equipment as required to comply with IEPA regulations. The equipment shall be enclosed if visible dust and debris are being emitted and/or the regulated area or high volume monitor lead levels are not in compliance.

Areas beneath containment connection points that were shielded from abrasive blast cleaning shall be prepared by vacuum blast cleaning or vacuum-shrouded power tool cleaning after the containment is removed.

b) Vacuum Blast Cleaning within Containment (SSPC-Class 4A)

Vacuum blasting equipment shall be fully automatic and capable of cleaning and recycling the abrasive. The system shall be designed to deliver cleaned, recycled blasting abrasives and provide a closed system containment during blasting. The removed coating, mill scale, and corrosion shall be separated from the abrasive, and stored for disposal.

The Contractor shall attach containment materials around and under the work area to catch and contain abrasive and waste materials in the event of an accidental escape from the vacuum shroud. This containment is in addition to the ground covers specified earlier.

It is possible that the close proximity of some structural steel members, such as the end diaphragms or end cross-frames underneath transverse deck expansion joints, preclude the use of the vacuum blasting equipment for the removal of the old paint. For surfaces that are inaccessible for the nozzles of the vacuum blasting equipment, the Contractor shall remove the paint by means of full containment inside a complete enclosure as directed by the Engineer.

c) Vacuum-Shrouded Power Tool Cleaning within Containment (SSPC-Class 3P)

The Contractor shall utilize power tools equipped with vacuums and High Efficiency Particulate Air (HEPA) filters. The Contractor shall attach containment walls around the work area, and install containment materials beneath the work area to catch and contain waste materials in the event of an accidental escape from the vacuum shroud. This containment is in addition to the ground covers specified earlier and shall be installed within 10 ft. (3m) of the areas being cleaned.

d) Power Tool Cleaning without Vacuum, within Containment (SSPC-Class 2P)

When the use of power tools without vacuum attachments is authorized by the Engineer, the Contractor shall securely install containment walls and flooring around the work area to capture and collect all debris that is generated. The containment material requirements for this Class 2P are similar to Class 3P used for vacuum-shrouded tools, but the supporting structure will be more substantial in Class 2P to better secure the containment materials from excessive movement that could lead to the loss of waste paint chips and debris. Containment beneath the work shall be within 10 ft. (3m) of the areas being cleaned, and is in addition to the ground covers specified earlier.

e) Water Washing, Water Jetting or Wet Abrasive Blast Cleaning within Containment (SSPC Class 2W-3W)

Water washing of the bridge for the purpose of removing chalk, dirt, grease, oil, bird nests, and other surface debris, and water jetting or wet abrasive blast cleaning for the purpose of removing paint and surface debris shall be conducted within a containment designed, installed, and maintained in order to capture and contain all water and waste materials. The containment shall consist of impermeable floors and lower walls to prevent the water and debris from escaping. Permeable upper walls and ceilings are acceptable provided the paint chips, debris, and water, other than mists, are collected. A fine mist passing through the permeable upper walls is acceptable, provided the environmental controls specified below are met. If paint chips, debris, or water, other than mists, escape the containment system, impermeable walls and ceilings shall be installed.

When water is used for surface cleaning, the collected water shall be filtered to separate the particulate from the water. Recycling of the water is preferred in order to reduce the volume of waste that is generated. The water after filtration shall be collected and disposed of according to the waste handling portions of this specification.

When a slurry is created by injecting water into the abrasive blast stream, the slurry need not be filtered to separate water from the particulate.

Environmental Controls and Monitoring. The Contractor shall prepare and submit to the Engineer for review and acceptance, an Environmental Monitoring Plan. The purpose of the plan is to address the observations and equipment monitoring undertaken by the Contractor to confirm that project dust and debris are not escaping the containment into the surrounding air, soil, and water.

- a) **Soil and Water.** Containment systems shall be maintained to prevent the escape of paint chips, abrasives, and other debris into the water, and onto the ground, soil, slope protection, and pavements. Releases or spills of, paint chips, abrasives, dust and debris that have become deposited on surrounding property, structures, equipment or vehicles, and bodies of water are unacceptable. If there are inadvertent spills or releases, the Contractor shall immediately shut down the emissions-producing operations, clean up the debris, and change work practices, modify the containment, or take other appropriate corrective action as needed to prevent similar releases from occurring in the future.

Water booms, boats with skimmers, or other means as necessary shall be used to capture and remove paint chips or project debris that falls or escapes into the water.

At the end of each workday at a minimum, the work area inside and outside of containment, including ground tarpaulins, shall be inspected to verify that paint debris is not present. If debris is observed, it shall be removed by hand and HEPA-vacuuuming. If wet methods of preparation are used, the damp debris can remain overnight provided it is protected from accidental release by securely covering the waste, folding the waste into the ground tarps, or by other acceptable methods. Prior to commencing work the next day, the debris from the folded ground tarps shall be removed.

Upon project completion, the ground and water in and around the project site are considered to have been properly cleaned if paint chips, paint removal media (e.g., spent abrasives), fuel, materials of construction, litter, or other project debris have been removed, even if the material being cleaned was a pre-existing condition.

- b) **Visible Emissions.** The Contractor shall conduct observations of visible emissions and releases on an ongoing daily basis when dust-producing activities are underway, such as paint removal, clean up, waste handling, and containment dismantling or relocation. Note that visible emissions observations do not apply to the fine mist that may escape through permeable containment materials when wet methods of preparation are used.

Visible emissions in excess of SSPC Guide 6, Level 1 (1% of the workday) are unacceptable. In an 8-hour workday, this equates to emissions of a cumulative duration no greater than 4.8 minutes (288 seconds). This criterion applies to scattered, random emissions of short duration. Sustained emissions from a given location (e.g., 1 minute or longer), regardless of the total length of emissions for the workday, are unacceptable and action shall be initiated to halt the emission.

If unacceptable visible emissions or releases are observed, the Contractor shall immediately shut down the emission-producing operations, clean up the debris, and change work practices, modify the containment, or take other appropriate corrective action as needed to prevent similar releases from occurring in the future.

- c) **Ambient Air Monitoring.** The Contractor shall collect and analyze air samples to evaluate levels of TSP-lead if there are sensitive receptors within 5 times the height of the structure or within 1000 ft. (305 m) of the structure, whichever is greater. If sensitive receptors are not located within these limits, monitoring is not required. Sensitive receptors are areas of

public presence or access including, but not limited to, homes, schools, parks, playgrounds, shopping areas, livestock areas, and businesses. The motoring public is not considered to be a sensitive receptor for the purpose of ambient air monitoring. The monitoring schedule shall be as follows:

For dry abrasive blast cleaning monitoring shall be conducted full time during all days of dust-producing operations (e.g., paint removal, waste handling, containment movement, etc.).

For wet abrasive blast cleaning, water jetting, or power tool cleaning, monitoring shall be conducted for the first 5 days of dust producing operations. If the results after 5 days are acceptable, monitoring may be discontinued. If the results are unacceptable, corrective action shall be initiated to correct the cause of the emissions, and monitoring shall continue for an additional 5 days. If the results are still unacceptable, the Engineer may direct that the monitoring continue full time.

When monitoring is discontinued, if visible emissions are observed and/or the Contractor's containment system changes during the course of the project, then air monitoring will again be required for a minimum of two consecutive days until compliance is shown.

All ambient air monitoring shall be performed by the Contractor according to the accepted QA Monitoring Plan and according to EPA regulations 40 CFR Part 50 Appendix B, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method), and 40 CFR Part 50 Appendix G, Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air.

The Contractor shall provide up to 4 monitors per work site and all necessary calibration and support equipment, power to operate them, security (or arrangements to remove and replace the monitors daily), filters, flow chart recorders and overnight envelopes for shipping the filters to the laboratory. The number of monitors required will be indicated in the General Notes. The Contractor shall also contract with a laboratory acceptable to the Engineer for the analysis. The laboratory performing the filter analysis shall be a laboratory that is accredited under the American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP) for metals analysis and under the EPA National Lead Laboratory Accreditation Program (NLLAP).

The Contractor shall locate the monitors in areas of public exposure and in areas that will capture the maximum pollutant emissions resulting from the work. The Contractor shall identify the recommended monitoring sites in the Environmental Monitoring Plan. The monitors shall not be sited until the Engineer accepts the proposed locations.

Background samples shall be collected for three days prior to the start of work while no paint disturbance operations are underway. The background monitoring shall include two weekdays and one weekend day. The background monitoring shall coincide with the anticipated working hours for the paint removal operations, but shall last for a minimum of 8 hours each day.

The filters shall be removed and replaced with new ones daily. The Contractor shall advise the Engineer in advance when the filters will be removed and replaced. Each day for the first 5 days of monitoring, the Contractor shall send the filters together with chart recorders (to record the volume of air and the run time of the monitor) in an overnight service envelope to the

laboratory for analysis. At the discretion of the Engineer, if the initial 5 days of monitoring on full time monitoring projects is acceptable, the filters may be sent to the laboratory every 3 days rather than every day.

TSP-lead results at each monitor location shall be less than 1.5 µg/cu m per calendar quarter converted to a daily allowance using the formulas from SSPC Guide 6 as follows, except that the maximum 24-hour daily allowance shall be no greater than 6 µg/cu m.

The formula for determining a 24-hour daily value based on the actual number of paint disturbance days expected to occur during the 90-day quarter is:

$$DA = (90 \div PD) \times 1.5 \text{ µg/cu m, where}$$

DA is the daily allowance, and PD is the number of preparation days anticipated in the 90-day period. If the DA calculation is > 6.0 µg/cu m, use 6.0 µg/cu m.

The formula for converting the 24-hour daily allowance to an adjusted daily allowance based on the length of the work shift each day (assuming that there are no lead emissions during the remaining non-working hours of the day) is:

$$ADA = DA (24 \div H), \text{ where}$$

ADA is the adjusted daily allowance,
DA is the daily allowance, and
H is the number of hours worked in 24 hours
If the ADA calculation is > 15.0 µg/cu m, use 15.0 µg/cu m

The Contractor shall calibrate the monitors according to the manufacturer's written instructions upon mobilization to the site and quarterly. Each monitor shall be tagged with the calibration date, and calibration information shall be provided to the Engineer upon request.

The laboratory results shall be delivered to the Engineer within 7 days of shipping the filters to the laboratory. The report shall include:

- 1 Monitor identification, location
- 2 Cleaning location
- 3 Volume of air sampled
- 4 Sample period
- 5 Sample results expressed in terms of applicable standards i.e. micrograms per cubic meter on a 24 hour time weighted average, or as an adjusted daily allowance.
- 6 Comparison of the results with the acceptance criteria indicating whether the emissions are compliant.

Regulated Areas. Physically demarcated regulated area(s) shall be established around exposure producing operations at the OSHA Action Level for the toxic metal(s) present in the coating. The Contractor shall provide all required protective clothing and equipment for personnel entering into a regulated area. Unprotected street clothing is not permitted within the regulated areas.

Hygiene Facilities/Protective Clothing/Blood Tests. The Contractor shall provide clean lavatory and hand washing facilities according to OSHA regulations and confirm that employees wash hands, forearms, and face before breaks. The facilities shall be located at the perimeter of the regulated area in close proximity to the paint removal operation. Shower facilities shall be provided when workers' exposures exceed the Permissible Exposure Limit. Showers shall be located at each bridge site, or if allowed by OSHA regulations, at a central location to service multiple bridges. The shower and wash facilities shall be cleaned at least daily during use.

All wash and shower water shall be filtered and containerized. The Contractor is responsible for filtration, testing, and disposal of the water.

The Contractor shall make available to all IDOT project personnel a base line and post project blood level screening determined by the whole blood lead method, utilizing the Vena-Puncture technique. This screening shall be made available every 2 months for the first 6 months, and every 6 months thereafter.

The Contractor shall provide IDOT project personnel with all required protective clothing and equipment, including disposal or cleaning. Clothing and equipment includes but is not limited to disposable coveralls with hood, booties, disposable surgical gloves, hearing protection, and safety glasses. The protective clothing and equipment shall be provided and maintained on the job site for the exclusive, continuous and simultaneous use by the IDOT personnel. This equipment shall be suitable to allow inspection access to any area in which work is being performed.

All handwash and shower facilities shall be fully available for use by IDOT project personnel.

Site Emergencies.

a) Stop Work. The Contractor shall stop work at any time the conditions are not within specifications and take the appropriate corrective action. The stoppage will continue until conditions have been corrected. Standby time and cost required for corrective action is at the Contractor's expense. The occurrence of the following events shall be reported in writing to IDOT and shall require the Contractor to automatically stop lead paint removal and initiate clean up activities.

- Airborne lead levels at any of the high volume ambient air monitoring locations that exceed the limits in this specification, or airborne lead in excess of the OSHA Action Level at the boundary of the regulated area.
- Break in containment barriers.
- Visible emissions in excess of the specification tolerances.
- Loss of negative air pressure when negative air pressure is specified (e.g., for dry abrasive blast cleaning).
- Serious injury within the containment area.
- Fire or safety emergency
- Respiratory system failure
- Power failure

b) Contingency Plans and Arrangements. The Engineer will refer to the contingency plan for site specific instructions in the case of emergencies.

The Contractor shall prepare a contingency plan for emergencies including fire, accident, failure of power, failure of dust collection system, failure of supplied air system or any other event that may require modification of standard operating procedures during lead removal. The plan shall include specific procedures to ensure safe egress and proper medical attention in the event of an emergency. The Contractor shall post the telephone numbers and locations of emergency services including fire, ambulance, doctor, hospital, police, power company and telephone company on clean side of personnel decontamination area.

A two-way radio, or equal, as approved by the Engineer, capable of summoning emergency assistance shall be available at each bridge during the time the Contractor's personnel are at the bridge site under this contract. The following emergency response equipment described in the contingency plan (generic form attached) shall be available during this time as well: an appropriate portable fire extinguisher, a 55 gal (208 L) drum, a 5 gal (19 L) pail, a long handled shovel, absorbent material (one bag).

A copy of the contingency plan shall be maintained at each bridge during cleaning operations and during the time the Contractor's personnel are at the bridge site under this contract. The Contractor shall designate the emergency coordinator(s) required who shall be responsible for the activities described.

An example of a contingency plan is included at the end of this Special Provision.

Collection, Temporary Storage, Transportation and Disposal of Waste. The Contractor and the Department are considered to be co-generators of the waste.

The Contractor is responsible for all aspects of waste collection, testing and identification, handling, storage, transportation, and disposal according to these specifications and all applicable Federal, State, and Local regulations. The Contractor shall provide for Engineer review and acceptance a Waste Management Plan that addresses all aspects of waste handling, storage, and testing, and provides the names, addresses, and a contact person for the proposed licensed waste haulers and disposal facilities. The Department will not perform any functions relating to the waste other than provide EPA identification numbers, provide the Contractor with the emergency response information, the emergency response telephone number required to be provided on the manifest, and to sign the waste manifest. The Engineer will obtain the identification numbers from the state and federal environmental protection agencies for the bridge(s) to be painted and furnish those to the Contractor.

All surface preparation/paint residues shall be collected daily and deposited in all-weather containers supplied by the Contractor as temporary storage. The storage area shall be secure to prevent unauthorized entry or tampering with the containers. Acceptable measures include storage within a fully enclosed (e.g., fenced in) and locked area, within a temporary building, or implementing other reasonable means to reduce the possibility of vandalism or exposure of the waste to the public or the environment (e.g., securing the lids or covers of waste containers and roll-off boxes). Waste shall not be stored outside of the containers. Waste shall be collected and transferred to bulk containers taking extra precautions as necessary to prevent the suspension of residues in air or contamination of surrounding surfaces. Precautions may include the transfer of the material within a tarpaulin enclosure. Transfer into roll-off boxes shall be planned to minimize the need for workers to enter the roll-off box.

No residues shall remain on surfaces overnight, either inside or outside of containment. Waste materials shall not be removed through floor drains or by throwing them over the side of the bridge. Flammable materials shall not be stored around or under any bridge structures.

The all-weather containers shall meet the requirements for the transportation of hazardous materials and as approved by the Department. Acceptable containers include covered roll-off boxes and 55-gallon drums (17H). The Contractor shall insure that no breaks and no deterioration of these containers occurs and shall maintain a written log of weekly inspections of the condition of the containers. A copy of the log shall be furnished to the Engineer upon request. The containers shall be kept closed and sealed from moisture except during the addition of waste. Each container shall be permanently identified with the date that waste was placed into the container, contract number, hazardous waste name and ID number, and other information required by the IEPA.

The Contractor shall have each waste stream sampled for each project and tested by TCLP and according to EPA and disposal company requirements. The Engineer shall be notified in advance when the samples will be collected. The samples shall be collected and shipped for testing within the first week of the project, with the results due back to the Engineer within 10 days. Testing shall be considered included in the pay item for "Containment and Disposal of Lead Paint Cleaning Residues." Copies of the test results shall be provided to the Engineer prior to shipping the waste.

Waste water generated from bridge washing, hygiene purposes, and cleaning of equipment shall be filtered on site to remove particulate and disposed of at a Publicly Owned Treatment Works (POTW) according to State regulations. The Contractor shall provide the Engineer with a letter from the POTW indicating that they will accept the waste water. If the POTW allows the filtered water to be placed into the sanitary sewer system, the Contractor shall provide a letter from the POTW indicating that based on the test results of the water, disposal in the sanitary sewer is acceptable to them. Water shall not be disposed of until the above letter(s) are provided to, and accepted by, the Engineer.

If approved abrasive additives are used that render the waste non-hazardous as determined by TCLP testing, the waste shall be classified as a non-hazardous special waste, transported by a licensed waste transporter, and disposed of at an IEPA permitted disposal facility in Illinois.

When paint is removed from the bridge without the use of abrasive additives, the paint, together with the surface preparation media (e.g. abrasive) shall be handled as a hazardous waste, regardless of the TCLP results. The waste shall be transported by a licensed hazardous waste transporter, treated by an IEPA permitted treatment facility to a non-hazardous special waste and disposed of at an IEPA permitted disposal facility in Illinois.

The treatment/disposal facilities shall be approved by the Engineer, and shall hold an IEPA permit for waste disposal and waste stream authorization for this cleaning residue. The IEPA permit and waste stream authorization must be obtained prior to beginning cleaning, except that if necessary, limited paint removal will be permitted in order to obtain samples of the waste for the disposal facilities. The waste shall be shipped to the facility within 90 days of the first accumulation of the waste in the containers. When permitted by the Engineer, waste from multiple bridges in the same contract may be transported by the Contractor to a central waste

storage location(s) approved by the Engineer in order to consolidate the material for pick up, and to minimize the storage of waste containers at multiple remote sites after demobilization. Arrangements for the final waste pickup shall be made with the waste hauler by the time blast cleaning operations are completed or as required to meet the 90 day limit stated above.

The Contractor shall submit a waste accumulation inventory table to the Engineer no later than the 5th day of the month. The table shall show the number and size of waste containers filled each day in the preceding month and the amount of waste shipped that month, including the dates of shipments.

The Contractor shall prepare a manifest supplied by the IEPA for off-site treatment and disposal before transporting the hazardous waste off-site. The Contractor shall prepare a land ban notification for the waste to be furnished to the disposal facility. The Contractor shall obtain the handwritten signature of the initial transporter and date of the acceptance of the manifest. The Contractor shall send one copy of the manifest to the IEPA within two working days of transporting the waste off-site. The Contractor shall furnish the generator copy of the manifest and a copy of the land ban notification to the Engineer. The Contractor shall give the transporter the remaining copies of the manifest.

All other project waste shall be removed from the site according to Federal, State and Local regulations, with all waste removed from the site prior to final Contractor demobilization.

The Contractor shall make arrangements to have other hazardous waste, which he/she generates, such as used paint solvent, transported to the Contractor's facility at the end of each day that this waste is generated. These hazardous wastes shall be manifested using the Contractor's own generator number to a treatment or disposal facility from the Contractor's facility. The Contractor shall not combine solvents or other wastes with cleaning residue wastes. All waste streams shall be stored in separate containers.

The Contractor is responsible for the payment of any fines and undertaking any clean up activities mandated by State or federal environmental agencies for improper waste handling, storage, transportation, or disposal.

Contractor personnel shall be trained in the proper handling of hazardous waste, and the necessary notification and clean up requirements in the event of a spill. The Contractor shall maintain a copy of the personnel training records at each bridge site.

Basis of Payment. The soil, water, and air monitoring, containment, collection, temporary storage, transportation, testing and disposal of all project waste, and all other work described herein will be paid for at the contract lump sum price for CONTAINMENT AND DISPOSAL OF LEAD PAINT CLEANING RESIDUES at the designated location. Payment will not be authorized until all requirements have been fulfilled as described in this specification, including the preparation and submittal of all QC documentation, submittal of environmental monitoring and waste test results, and disposal of all waste.

Appendix 1 – Reference List

The Contractor shall maintain the following reference standards and regulations on site for the duration of the project:

- Illinois Environmental Protection Agency – Information Statement on the Removal of Lead-Based Paint from Exterior Surfaces, latest revision
- Illinois Environmental Protection Act
- SSPC Guide 6, Guide for Containing Debris Generated During Paint Removal Operations
- 29 CFR 1926.62, Lead in Construction
- 40 CFR Part 50, Appendix B, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method)
- 40 CFR Part 50, Appendix G, Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air
- SSPC Guide 16, Guide to Specifying and Selecting Dust Collectors
- SSPC TU-7, Conducting Ambient Air, Soil, and Water Sampling Activities During Surface Preparation and Paint Disturbance Activities.

Table 1 Containment Criteria for Removal of Paint Containing Lead and Other Toxic Metals¹					
Removal Method	SSPC Class²	Containment Material Flexibility	Containment Material Permeability³	Containment Support Structure	Containment Material Joints⁴
Hand Tool Cleaning	3P6	Rigid or Flexible	Permeable or Impermeable	Minimal	Partially Sealed
Power Tool Cleaning w/ Vacuum	3P6	Rigid or Flexible	Permeable or Impermeable	Minimal	Partially Sealed
Power Tool Cleaning w/o Vacuum	2P	Rigid or Flexible	Permeable or Impermeable	Rigid or Flexible	Fully or Partially Sealed
Water Jetting Wet Ab Blast Water Cleaning ⁷	2W-3W	Rigid or Flexible	Permeable and Impermeable ⁷	Rigid, Flexible, or Minimal	Fully and Partially Sealed
Abrasive Blast Cleaning	1A	Rigid or Flexible	Impermeable	Rigid or Flexible	Fully Sealed
Vacuum Blast Cleaning	4A6	Rigid or Flexible	Permeable	Minimal	Partially Sealed

Table 1 (Continued) Containment Criteria for Removal of Paint Containing Lead and Other Toxic Metals¹					
Removal Method	SSPC Class²	Containment Entryway	Ventilation System Required⁵	Negative Pressure Required	Exhaust Filtration Required
Hand Tool Cleaning	3P6	Overlapping or Open Seam	Natural	No	No
Power Tool Cleaning w/ Vacuum	3P6	Overlapping or Open Seam	Natural	No	No
Power Tool Cleaning w/o Vacuum	2P	Overlapping or Open Seam	Natural	No	No

Water Jetting Wet Ab Blast Water Cleaning ⁷	2W-3W	Overlapping or Open Seam	Natural	No	No
Abrasive Blast Cleaning	1A	Airlock or Resealable	Mechanical	Yes	Yes
Vacuum Blast Cleaning	4A6	Open Seam	Natural	No	No

Notes:

¹ This table provides general design criteria only. It does not guarantee that specific controls over emissions will occur because unique site conditions must be considered in the design. Other combinations of materials may provide controls over emissions equivalent to or greater than those combinations shown above.

² The SSPC Classification is based on SSPC Guide 6. Note that for work over water, water booms or boats with skimmers must be employed, where feasible, to contain spills or releases. Debris must be removed daily at a minimum.

³ Permeability addresses both air and water as appropriate. In the case of water removal methods, the containment materials must be resistant to water. Ground covers should always be impermeable, and of sufficient strength to withstand the impact and weight of the debris and the equipment used for collection and clean-up. Ground covers must also extend beyond the containment boundary to capture escaping debris.

⁴ If debris escapes through the seams, then additional sealing of the seams and joints is required.

⁵ When "Natural" is listed, ventilation is not required provided the emissions are controlled as specified in this Special Provision, and provided worker exposures are properly controlled. If unacceptable emissions or worker exposures to lead or other toxic metals occur, incorporate a ventilation system into the containment.

⁶ Ground covers and wall tarpaulins may provide suitable controls over emissions without the need to completely enclose the work area.

⁷ This method applies to water cleaning to remove surface contaminants, and water jetting (with and without abrasive) and wet abrasive blast cleaning where the goal is to remove paint. Although both permeable and impermeable containment materials are included, ground covers and the lower portions of the containment must be water impermeable with fully sealed joints, and of sufficient strength and integrity to facilitate the collection and holding of the water and debris for proper disposal. If water or debris, other than mist, escape through upper sidewalls or ceiling areas constructed of permeable materials, they shall be replaced with impermeable materials. Permeable materials for the purpose of this specification are defined as materials with openings measuring 25 mils (1 micron) or less in greatest dimension.

A. Containment Components - The basic components that make up containment systems are defined below. The components are combined in Table 1 to establish the minimum containment system requirements for the method(s) of paint removal specified for the Contract.

1 Rigidity of Containment Materials - Rigid containment materials consist of solid panels of plywood, aluminum, rigid metal, plastic, fiberglass, composites, or similar materials. Flexible materials consist of screens, tarps, drapes, plastic sheeting, or similar materials. When directed by the Engineer, do not use flexible materials for horizontal surfaces directly over traffic lanes or vertical surfaces in close proximity to traffic lanes. If the Engineer allows the use of flexible materials, The Contractor shall take special precautions to completely secure the materials to prevent any interference with traffic.

2 Permeability of Containment Materials - The containment materials are identified as air impenetrable if they are impervious to dust or wind such as provided by rigid panels, coated solid tarps, or plastic sheeting. Air penetrable materials are those that are formed or woven to allow air flow. Water impermeable materials are those that are capable of containing and controlling water when wet methods of preparation are used. Water permeable materials allow the water to pass through. Chemical resistant materials are those resistant to chemical and solvent stripping solutions. Use fire retardant materials in all cases.

3 Support Structure - Rigid support structures consist of scaffolding and framing to which the containment materials are affixed to minimize movement of the containment cocoon. Flexible support structures are comprised of cables, chains, or similar systems to which the containment materials are affixed. Use fire retardant materials in all cases.

4 Containment Joints - Fully sealed joints require that mating surfaces between the containment materials and to the structure being prepared are completely sealed. Sealing measures include tape, caulk, Velcro, clamps, or other similar material capable of forming a continuous, impenetrable or impermeable seal. When materials are overlapped, a minimum overlap of 8 in. (200 mm) is required.

5 Entryway -An airlock entryway involves a minimum of one stage that is fully sealed to the containment and which is maintained under negative pressure using the ventilation system of the containment. Resealable door entryways involve the use of flexible or rigid doors capable of being repeatedly opened and resealed. Sealing methods include the use of zippers, Velcro, clamps, or similar fasteners. Overlapping door tarpaulin entryways consist of two or three overlapping door tarpaulins.

1 Mechanical Ventilation - The requirement for mechanical ventilation is to ensure that adequate air movement is achieved to reduce worker exposure to toxic metals to as low as feasible according to OSHA regulations (e.g., 29 CFR 1926.62), and to enhance visibility. Design the system with proper exhaust ports or plenums, adequately sized ductwork, adequately sized discharge fans and air cleaning devices (dust collectors) and properly sized and distributed make-up air points to achieve a uniform air flow inside containment for visibility. The design target for airflow shall be a minimum of 100 ft. (30.5m) per minute cross-draft or 60 ft. (18.3 m) per minute downdraft. Increase these minimum airflow requirements if necessary to address worker lead exposures. Natural ventilation does not require the use of mechanical equipment for moving dust and debris through the work area.

2 Negative Pressure - When specified, achieve a minimum of 0.03 in. (7.5 mm) water column (W.C.) relative to ambient conditions, or confirm through visual assessments for the concave appearance of the containment enclosure.

3 Exhaust Ventilation - When mechanical ventilation systems are used, provide filtration of the exhaust air, to achieve a filtration efficiency of 99.9 percent at 0.02 mils (0.5 microns).

HAZARDOUS WASTE
CONTINGENCY PLAN
FOR
LEAD BASED PAINT REMOVAL PROJECTS

Bridge No.: _____
Location: _____
USEPA Generator No.: _____
IEPA Generator No.: _____

Note:

1. A copy of this plan must be kept at the bridge while the Contractor's employees are at the site.
2. A copy of the plan must be mailed to the police and fire departments and hospital identified herein.

Primary Emergency Coordinator

Name: _____
Address: _____
City: _____
Phone: (Work) _____
(Home) _____

Alternate Emergency Coordinator

Name: _____
Address: _____
City: _____
Phone: (Work) _____
(Home) _____

Emergency Response Agencies

POLICE:

- 1. State Police (if bridge not in city) Phone: _____
District No. _____
Address: _____
- 2. County Sheriff _____ Phone: _____
County: _____
Address: _____
- 3. City Police _____ Phone: _____
District No. _____
Address: _____

Arrangements made with police: (Describe arrangements or refusal by police to make arrangements):

FIRE:

- 1. City _____ Phone: _____
Name: _____
Address: _____
- 2. Fire District _____ Phone: _____
Name: _____
Address: _____

3. Other _____ Phone: _____

Name: _____

Address: _____

Arrangements made with fire departments: (Describe arrangements or refusal by fire departments to make arrangements):

HOSPITAL:

Name: _____ Phone: _____

Address: _____

Arrangements made with hospital: (Describe arrangements or refusal by hospital to make arrangements):

Properties of waste and hazard to health:

Places where employees working:

Location of Bridge:

Types of injuries or illness which could result:

Appropriate response to release of waste to the soil:

Appropriate response to release of waste to surface water:

Emergency Equipment at Bridge

Emergency Equipment List	Location of Equipment	Description of Equipment	Capability of Equipment
1. Two-way radio	Truck		Communication
2. Portable Fire	Truck		Extinguishes Fire
3. Absorbent Material	Truck		Absorbs Paint or Solvent Spills
4. Hand Shovel	Truck		Scooping Material
5. 55 Gallon (208 L) Drum	Truck		Storing Spilled Material
6. 5 Gallon (19 L) Pail	Truck		Storing Spilled Material

Emergency Procedure

1. Notify personnel at the bridge of the emergency and implement emergency procedure.
2. Identify the character, source, amount and extent of released materials.
3. Assess possible hazards to health or environment.
4. Contain the released waste or extinguish fire. Contact the fire department if appropriate.
5. If human health or the environment is threatened, contact appropriate police and fire department. In addition, the Emergency Services and Disaster Agency needs to be called using their 24-hour toll free number (800-782-7860) and the National Response Center using their 24-hour toll free number (800-824-8802).
6. Notify the Engineer that an emergency has occurred.
7. Store spilled material and soil contaminated by spill, if any, in a drum or pail. Mark and label the drum or pail for disposal.
8. Write a full account of the spill or fire incident including date, time, volume, material, and response taken.
9. Replenish stock of absorbent material or other equipment used in response.

DECK SLAB REPAIR

Effective: May 15, 1995

Revised: January 12, 2009

This work shall consist of hot-mix asphalt surface removal, when required, the removal and disposal of all loose and deteriorated concrete from bridge deck and the replacement with new concrete to the original top of deck. The work shall be done according to the applicable requirements of Sections 501, 503 and 1020 of the Standard Specifications and this Special Provision.

Deck slab repairs will be classified as follows:

(a) Partial-Depth. Partial-depth repairs shall consist of removing the loose and unsound deck concrete, disposing of the concrete removed and replacing with new concrete. The removal may be performed by chipping with power driven hand tools or by hydro-scarification equipment. The depth shall be measured from the top of the concrete deck surface, at least 3/4 in. (20 mm) but not more than 1/2 the concrete deck thickness.

(b) Full-Depth. Full-depth repairs shall consist of removing concrete full-depth of the deck, disposing of the concrete removed, and replacing with new concrete to the original concrete deck surface. The removal may be performed with power driven hand tools or by hydro-scarification equipment. Full-depth repairs shall be classified for payment as Full-Depth, Type I and Full-Depth, Type II according to the following:

Type I Full-depth patches less than or equal to 5 sq. ft. (0.5 sq m) in area. The minimum dimensions for a patch shall be 1 ft. x 1 ft. (300 mm x 300 mm).

Type II Full-depth patches greater than 5 sq. ft. (0.5 sq. m) in area.

Materials.

Materials shall be according to Article 1020.02.

Portland cement concrete for partial and full-depth repairs shall be according to Section 1020. Class PP-1, PP-2, PP-3, PP-4, PP-5 or BS concrete shall be used at the Contractor's option. For Class BS concrete, a CA 13, 14, or 16 shall be used. If the BS concrete mixture is used only for full depth repairs, a CA-11 may be used. In Section 1020, revise the second sentence of Note 10 for Table 1 of Article 1020.04 to read as follows for Class PP concrete: "The bridge deck patching mix design strength shall be increased to 4000 psi (27,500 kPa) compressive or 675 psi (4650 kPa) flexural, and the mixture shall have 72 hours to obtain the required strength."

Grout. The grout for bonding new concrete to old concrete shall be proportioned by weight (mass) and mixed at the job site, or it may be ready-mixed if agitated while at the job site. The bonding grout shall consist of one part portland cement and one part sand, mixed with sufficient water to form a slurry. The bonding grout shall have a consistency allowing it to be scrubbed onto the prepared surface with a stiff brush or broom leaving a thin, uniform coating that will not run or puddle in low spots. Grout that can not be easily and evenly applied or has lost its consistency may be rejected by the Engineer. Grout that is more than two hours old shall not be used.

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 and concrete removal equipment shall be according to the applicable portions of Section 1100 and the following:

(1) Sawing Equipment. Sawing equipment shall be a concrete saw capable of sawing concrete to the specified depth.

(2) Blast Cleaning Equipment. The blast cleaning may be performed by wet sandblasting, high-pressure waterblasting, shotblasting or abrasive blasting. Blast cleaning equipment shall be capable of removing rust and old concrete from exposed reinforcement bars, and shall have oil traps.

(3) Power-Driven Hand Tools. Power-driven hand tools will be permitted including jackhammers lighter than the nominal 45 lb. (20 kg) class. Chipping hammers heavier than a nominal 15 lb. (6.8 kg) class shall not be used for removing concrete from below any reinforcing bar for partial depth repairs or final removal at the boundary of full-depth repairs. Jackhammers or chipping hammers shall not be operated at an angle in excess of 45 degrees measured from the surface of the slab.

(4) Hydro-Scarification Equipment. The hydro-scarification equipment shall consist of filtering and pumping units operating with a remote-controlled robotic device. The equipment may use river, stream or lake water. Operation of the equipment shall be performed and supervised by qualified personnel certified by the equipment manufacturer. Evidence of certification shall be presented to the Engineer. The equipment shall be capable of removing concrete to the specified depth and removing rust and concrete particles from exposed reinforcing bars. Hydro-scarification equipment shall be calibrated before being used and shall operate at a minimum of 18,000 psi (124 MPa).

(b) Concrete Equipment: Equipment for proportioning and mixing the concrete shall be according to Article 1020.03.

(c) Finishing Equipment: Finishing equipment shall be according to Article 1103.17. Adequate hand tools will be permitted for placing and consolidating concrete in the patch areas and for finishing small patches.

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 removal and 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 construction debris into adjacent waters, and shall properly dispose of the solids generated according to Article 202.03. Runoff water will not be allowed to constitute a hazard on adjacent or underlying roadways, waterways, drainage areas or railroads nor be allowed to erode existing slopes.

(a) Hot-Mix Asphalt Surface Removal.

The hot-mix asphalt surface course and all waterproofing membrane shall be removed and disposed of according to applicable portions of Articles 440.04 and 440.06, except milling equipment will not be allowed if the deck is to receive a waterproofing membrane system. If the overlay or waterproofing membrane contains asbestos fibers, removal shall be in accordance with the Special Provision for "Asbestos Waterproofing Membrane or Asbestos Hot-mix Asphalt Surface Removal". Removal of the hot-mix asphalt surface by the use of radiant or direct heat will not be permitted.

(b) Surface Preparation:

All loose, disintegrated and unsound concrete shall be removed from portions of the deck slab shown on the plans or as designated by the Engineer. The Engineer will determine the limits of removal as the work progresses.

The Contractor shall take care not to damage reinforcement bars or expansion joints which are to remain in place. Any damage to reinforcement bars or expansion joints shall be corrected at the Contractor's expense. All loose reinforcement bars, as determined by the Engineer, shall be retied at the Contractor's expense.

(1) Partial-Depth. Areas to be repaired will be determined and marked by the Engineer. A concrete saw shall be used to provide vertical edges approximately 3/4 in. (20 mm) deep around the perimeter of the area to be patched when a concrete overlay is not specified. Where high steel is present, the depth may be reduced as directed by the Engineer. A saw cut will not be required on those boundaries along the face of the curb, parapet or joint or when sharp vertical edges are provided by hydro-scarification.

The loose and unsound concrete shall be removed by chipping, with power driven hand tools or by hydro-scarification equipment. All exposed reinforcing bars and newly exposed concrete shall be thoroughly blast cleaned. Where, in the judgment of the Engineer, the bond between existing concrete and reinforcement steel within the patch area has been destroyed, the concrete adjacent to the bar shall be removed to a depth that will permit new concrete to bond to the entire periphery of the exposed bar. A minimum of 1 in. (25 mm) clearance will be required. The Engineer may require enlarging a designated removal area should inspection indicate deterioration beyond the limits previously designated. In this event, a new saw cut shall be made around the extended area before additional removal is begun. The removal area shall not be enlarged solely to correct debonded reinforcement or deficient lap lengths.

(2) Full-Depth. Concrete shall be removed as determined by the Engineer within all areas designated for full-depth repair and in all designated areas of partial depth repair in which unsound concrete is found to extend below half the concrete deck thickness. Full depth removal shall be performed according to Article 501.05. Saw cuts shall be made on the top of the deck, except those boundaries along the face of curbs, parapets and joints or where hydro-scarification provided sharp vertical edges. The top saw cut may be omitted if the deck is to receive an overlay.

Forms for full-depth repair may be supported by hangers with adjustable bolts or by blocking from the beams below. When approved by the Engineer, forms for Type 1 patches may be supported by No. 9 wires or other devices attached to the reinforcement bars.

All form work shall be removed after the curing sequence is complete and prior to opening to traffic.

- (3) Reinforcement Treatment. Care shall be exercised during concrete removal to protect the reinforcement bars and structural steel from damage. Any damage to the reinforcement bars or structural steel to remain in place shall be repaired or replaced to the satisfaction of the Engineer at the Contractor's expense. All existing reinforcement bars shall remain in place except as herein provided for corroded bars. Tying of loose bars will be required. Reinforcing bars which have been cut or have lost 25 percent or more of their original cross sectional area shall be supplemented by new in kind reinforcement bars. New bars shall be lapped a minimum of 32 bar diameters to existing bars. An approved mechanical bar splice capable of developing in tension at least 125 percent of the yield strength of the existing bar shall be used when it is not feasible to provide the minimum bar lap. No welding of bars will be permitted.
- (4) Cleaning. Immediately after completion of the concrete removal and reinforcement repairs, the repair areas shall be cleaned of dust and debris. Once the initial cleaning is completed, the repair areas shall be thoroughly blast cleaned to a roughened appearance free from all foreign matter. Particular attention shall be given to removal of concrete fines. Any method of cleaning which does not consistently produce satisfactory results shall be discontinued and replaced by an acceptable method. All debris, including water, resulting from the blast cleaning 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 cleaning, the area shall be carefully protected with well-anchored polyethylene sheeting.

Exposed reinforcement bars shall be free of dirt, detrimental scale, paint, oil, or other foreign substances which may reduce bond with the concrete. A tight non-scaling coating of rust is not considered objectionable. Loose, scaling rust shall be removed by rubbing with burlap, wire brushing, blast cleaning or other methods approved by the Engineer.

(c) Placement & Finishing of Concrete Repair:

- (1) Grout Placement. After the repair areas have been cleaned and immediately prior to concrete placement, the grout shall be applied to a dampened surface. A thin layer of grout shall be thoroughly scrubbed into the deck surface. All vertical as well as horizontal surfaces shall receive a thorough, even coating. The rate of grout placement shall be limited so the brushed grout does not dry out before it is covered with concrete. Grout that has become dry and chalky shall be blast cleaned and replaced at the Contractor's expense. No concrete shall be placed over dry grout.

(2) Concrete Placement. The concrete shall be placed and consolidated according to Article 503.07 and as herein specified. Article 1020.14 shall apply.

When an overlay system is not specified, the patches shall be finished according to Article 503.16(a), followed by a light brooming.

(d) Curing and Protection

Concrete patches shall be cured by the Wetted Burlap or Wetted Cotton Mat Method according to Article 1020.13 (a)(3) or Article 1020.13 (a)(5). The curing period shall be 3 days for Class PP-1, PP-2, PP-3, PP-4, and PP-5 concrete. The curing period shall be 7 days for Class BS concrete. In addition to Article 1020.13, when the air temperature is less than 55° F (13° C), the Contractor shall cover the patch according to Article 1020.13 (d)(1) with minimum R12 insulation. Insulation is optional when the air temperature is 55° F. - 90° F (13° C - 32° C). Insulation shall not be placed when the air temperature is greater than 90° F (32° C). A 72-hour minimum drying period shall be required before placing waterproofing or hot-mix asphalt surfacing.

(e) Opening to Traffic

No traffic will be permitted on a patch until after the specified cure period, and the concrete has obtained a minimum compressive strength of 4000 psi (27.6 MPa) or flexural strength of 675 psi (4.65 MPa).

Construction equipment will be permitted on a patch during the cure period if the concrete has obtained the minimum required strength. In this instance, the strength specimens shall be cured with the patch.

Method of Measurement

When specified, hot-mix asphalt surface removal and full or partial depth repairs will be measured for payment and computed in square yards (square meters).

Basis of Payment

The hot-mix asphalt surface removal will be paid for at the contract unit price per square yard (square meter) for HOT-MIX ASPHALT SURFACE REMOVAL (DECK). Areas removed and replaced up to and including a depth of half the concrete deck thickness will be paid for at the contract unit price per square yard (square meter) for DECK SLAB REPAIR (PARTIAL). Areas requiring removal greater than a depth of half the concrete deck thickness shall be removed and replaced full depth and will be paid for at the contract unit price per square yard (square meter) for DECK SLAB REPAIR (FULL DEPTH, TYPE I) and/or DECK SLAB REPAIR (FULL DEPTH, TYPE II).

When corroded reinforcement bars are encountered in the performance of this work and replacement is required, the Contractor will be paid according to Article 109.04.

No payment will be allowed for removal and replacement of reinforcement bars damaged by the Contractor in the performance of his/her work or for any increases in dimensions needed to provide splices for these replacement bars.

Removal and disposal of asbestos waterproofing and/or asbestos bituminous concrete will be paid for as specified in the Special Provision for "Asbestos Waterproofing Membrane or Asbestos Hot-Mix Asphalt Surface Removal".

BRIDGE DECK LATEX CONCRETE OVERLAY

Effective: May 15, 1995

Revised: May 11, 2009

This work shall consist of the preparation of the existing concrete bridge deck and the construction of a latex overlay to the specified thickness. The minimum thickness of the overlay shall be 2 1/4 in. (60 mm).

Materials. Materials shall meet the following Articles of Section 1000:

Item	Section
(a) Latex/Portland Cement Concrete (Note 1) (Note 2)	1020
(b) Grout (Note 3)	
(c) Packaged Rapid Hardening Mortar or Concrete	1018
(d) Concrete Curing Materials	1022.02

Note 1: This item shall include the initial on site technical assistance of the supplier of the latex admixture. Further technical assistance shall be available at the request of the Engineer. Any cement found to be incompatible in any respect for the latex overlay shall be removed from the work immediately and replaced with compatible cement at the Contractor's expense.

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 aggregates shall be CA 13, CA 14 or CA 16.

Note 3: Grout. The grout for bonding new concrete to old concrete shall be proportioned by weight (mass) and mixed at the job site, or it may be ready-mixed if agitated while at the job site. The bonding grout shall consist of one part portland cement and two parts sand, mixed with sufficient water to form a slurry. The bonding grout shall have a consistency allowing it to be scrubbed onto the prepared surface with a stiff brush or broom leaving a thin, uniform coating that will not run or puddle in low spots. Grout that can not be easily and evenly applied or has lost its consistency may be rejected by the Engineer. Grout that is more than two hours old shall not be used.

At the option of the Contractor the grout may be applied by mechanical applicators. If this option is chosen, the sand shall be eliminated from the grout mix. 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 157 lb. (93.1 kg) maximum fine and coarse aggregates)

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

Compressive Strength (14 days) 4000 psi (27,500 kPa) minimum Flexural Strength (14 days) 675 psi (4,650 kPa)

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) Sawing Equipment. Sawing equipment shall be a concrete saw capable of sawing concrete to the specified depth.

(2) Mechanical Blast Cleaning Equipment. Mechanical blast cleaning may be performed by high-pressure waterblasting or shotblasting. Mechanical blast cleaning equipment shall be capable of removing weak concrete at the surface, including the microfractured concrete surface layer remaining as a result of mechanical scarification, and shall have oil traps.

Mechanical high-pressure waterblasting equipment shall be mounted on a wheeled carriage and shall include multiple nozzles mounted on a rotating assembly. 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.

(3) 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.

Hand-held high-pressure waterblasting equipment that is used in areas inaccessible to mechanical blast cleaning equipment shall have a minimum pressure of 7000 psi (48 MPa).

(4) Mechanical Scarifying Equipment. Scarifying equipment shall be a power-operated, mechanical scarifier capable of uniformly scarifying or removing the old concrete surface and new patches to the depths required in a satisfactory manner. Other types of removal devices may be used if their operation is suitable and they can be demonstrated to the satisfaction of the Engineer.

(5) Hydro-Scarification Equipment. The hydro-scarification equipment shall consist of filtering and pumping units operating with a computerized, self-propelled robotic machine with gauges and settings that can be easily verified. The equipment shall use potable water according to Section 1002. Operation of the equipment shall be performed and supervised by qualified personnel certified by the equipment manufacturer. Evidence of certification shall be presented to the Engineer. The equipment shall be capable of removing concrete to the specified depth and be capable of removing rust and old concrete particles from exposed reinforcement bars. The hydro-scarification equipment shall be calibrated before being used and shall operate at a uniform pressure sufficient to remove the specified depth of concrete in a timely manner.

(6) 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.

(7) 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.

(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 Germann Instruments, Inc.
007 Bond Tester BOND-TEST Pull-off System
800-426-6500 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 1103.17 (k).

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 scarification and 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 construction debris into adjacent waters, and shall properly dispose of the solids generated according to Article 202.03. Runoff water will not be allowed to constitute a hazard on adjacent or underlying roadways, waterways, drainage areas or railroads nor be allowed to erode existing slopes.

(a) Deck Preparation:

- (1) Bridge Deck Scarification. The scarification work shall consist of removing the designated concrete deck surface using mechanical or hydro-scarifying equipment as specified. The areas designated shall be scarified uniformly to the depth as specified on the plans. In areas of the deck not accessible to the scarifying equipment, power-driven hand tools will be permitted. Power driven hand tools shall be used for removal around areas to remain in place.

A trial section on the existing deck surface will be designated by the Engineer to demonstrate that the equipment, personnel and methods of operation are capable of producing results satisfactory to the Engineer. The trial section will consist of approximately 30 sq. ft. (3 sq. m).

Once the settings for the equipment are established, they shall not be changed without the permission of the Engineer. The removal shall be verified, as necessary, at least every 16 ft. (5 m) along the cutting path. If sound concrete is being removed below the desired depth, the equipment shall be reset or recalibrated.

If the use of hydro-scarification equipment is specified, the Contractor may use mechanical scarification equipment to remove an initial depth of concrete provided that the last 1/4 in. (6 mm) of removal is accomplished with hydro-scarification equipment. If the Contractor's use of mechanical scarifying equipment results in exposing, snagging, or dislodging the top mat of reinforcing steel, the scarifying shall be stopped immediately and the remaining removal shall be accomplished using the hydro-scarification equipment. All damage to the existing reinforcement resulting from the Contractor's operation shall be repaired or replaced at the Contractor's expense as directed by the Engineer. Replacement shall include the removal of any additional concrete required to position or splice the new reinforcing steel. Undercutting of exposed reinforcement bars shall only be as required to replace or repair damaged or corroded reinforcement. Repairs to existing reinforcement shall be according to the Special Provision for "Deck Slab Repair".

After hydro-scarification the deck shall be vacuum cleaned in a timely manner before the water and debris are allowed to dry and re-solidify to the deck. The uses of alternative cleaning and debris removal methods to minimize driving heavy vacuum equipment over exposed deck reinforcement may be used subject to the approval of the Engineer.

- (2) Deck Patching. After bridge deck scarification, all designated patching, except as note below, shall be completed according to the Special Provision for "Deck Slab Repair". All full depth patching shall be completed prior to final surface preparation. When hydro-scarification is specified, partial depth patches may be fill with overlay material at the time of overlay placement.

All patches placed prior to overlay placement shall be struck off and then roughened with a suitable stiff bristled broom or wire brush to provide a rough texture designed to promote bonding of the overlay. Hand finishing of the patch surface shall be kept to a minimum to prevent overworking of the surface.

After scarification, the deck shall be thoroughly cleaned of broken concrete and other debris. The Engineer will sound the scarified deck and all remaining unsound areas will be marked for additional removal and/or repairs as applicable. If the bottom mat of reinforcement is exposed, that area shall be defined as a full depth repair.

In areas where hydro-scarification is specified, No separate payment for partial depth patching will be made regardless of whether it was detailed in the plans or not. Just prior to performing hydro-scarification, the deck shall be sounded, with unsound areas marked on

the deck to assist the hydro-scarification process in performing the partial depth removal simultaneously with the hydro-scarification operation. If in the opinion of the Engineer additional removal is required after the hydro-scarification process, which could not have been anticipated or accounted for by normal modifications to the scarification process (such as modifying the dwell time or Nozzle pressure), such removal shall be paid for according to Article 109.04. Any removal required or made below the specified depth for scarification of the bridge deck, which does not result in full depth patching, shall be filled with the overlay material at the time of the overlay placement.

- (3) Final Surface Preparation. Final surface preparation shall consist of the operation of mechanical blast cleaning equipment to remove any weak concrete at the surface, including the microfractured concrete surface layer remaining as a result of mechanical scarification. Any areas determined by the Engineer to be inaccessible to mechanical equipment shall be thoroughly blast cleaned with hand-held equipment. When hydro-scarification equipment is used for concrete removal, the deck surface need not be blast cleaned with mechanical equipment unless the spoils from the scarification operation are allowed to dry and re-solidify on the deck surface.

Final surface preparation shall also include the cleaning of all dust, debris, and concrete fines 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, depressions, and beneath reinforcement bars. Hand-held high-pressure waterblasting equipment shall be used for this operation.

If mechanical scarification is used to produce the final deck surface texture, surface pull-off testing will be required. After the final surface preparation has been completed and before placement of the overlay, the prepared deck surface will be tested by the Engineer according to the Illinois Test Procedure 304 "Pull-off Test (Surface Method)". The Contractor shall provide the test equipment.

- a. Start-up Testing. Prior to the first overlay placement, the Engineer will evaluate the blast cleaning method. The start-up area shall be a minimum of 600 sq. ft. (56 sq. m). After the area has been prepared, six random test locations will be determined by the Engineer, and tested according to the Illinois Test Procedure 304 "Pull-off Test (Surface Method)".

The average of the six tests shall be a minimum of 175 psi (1,207 kPa) and each individual test shall have a minimum strength of 160 psi (1,103 kPa). If the criteria are not met, the Contractor shall adjust the blast cleaning method. Startup testing will be repeated until satisfactory results are attained.

Once an acceptable surface preparation method is established, it shall be continued for the balance of the work. The Contractor may, with the permission of the Engineer, change the surface preparation method, in which case, additional start-up testing will be required.

- b. Lot Testing. After start-up testing has been completed, the following testing frequency will be used. For each structure, each stage will be divided into lots of not more than 4500 sq. ft. (420 sq. m). Three random test locations will be determined by the Engineer for each lot, and tested according to the Illinois Test Procedure 304 "Pull-off Test (Surface Method)".

The average of the three tests shall be a minimum of 175 psi (1,207 kPa) and each individual test shall have a minimum strength of 160 psi (1,103 kPa). In the case of a failing individual test or a failing average of three tests, the Engineer will determine the area that requires additional surface preparation by the Contractor. Additional test locations will be determined by the Engineer.

In addition to start-up and lot testing, the Department may require surface pull-off testing of areas inaccessible to mechanical blast cleaning equipment and blast cleaned with hand-held equipment. The Engineer shall determine each test location, and each individual test shall have a minimum strength of 175 psi (1,207 kPa).

Exposed reinforcement bars shall be free of dirt, detrimental scale, paint, oil, and other foreign substances which may reduce bond with the concrete. A tight non-scaling coating of rust is not considered objectionable. Loose, scaling rust shall be removed by rubbing with burlap, wire brushing, blast cleaning or other methods approved by the Engineer. All loose reinforcement bars, as determined by the Engineer, shall be retied at the Contractor's expense.

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 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 overlaid 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) Placement Procedure: Concrete placement shall be according to Article 503.07 and the following:

(1) Bonding Methods. The Contractor shall prepare the deck prior to overlay placement by one of the following methods unless restricted as specified on the plans:

- a. Grout Method. The deck shall be cleaned to the satisfaction of the Engineer and shall be thoroughly wetted and maintained in a dampened condition for at least 12 hours before placement of the grout is started. Any excess water shall be removed by compressed air or by vacuuming prior to grout placement. Water shall not be applied to the deck surface within one hour before or at any time during placement of the grout. Immediately before placing the overlay mixture, the exposed area shall be thoroughly covered with a thin layer of grout. The grout shall be thoroughly scrubbed into the surface. All vertical as well as horizontal surfaces shall receive a thorough, even coating. The rate of grout placement shall be limited so the brushed grout does not dry out before it is covered with the concrete.

Grout that is allowed to become dry and chalky shall be blast cleaned and replaced at the Contractor's expense. No concrete shall be placed over dry grout.

b. Direct Bond 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 a continuous operation throughout the pour. The overlay shall be placed as close to its final position as possible and then mechanically consolidated and screeded to final grade. All fogging, finishing, and texturing 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. 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. Mobile concrete mixers, truck mixers, concrete pumps, or other heavy equipment will not be permitted on any portion of the deck where the top reinforcing mat has been exposed. Conveyors, buggy ramps and pump piping shall be installed in a way that will not displace undercut reinforcement bars. Air compressors may be operated on the deck only if located directly over a pier and supported off undercut reinforcement bars. Compressors will not be allowed to travel over undercut reinforcement bars.

Concrete removal may proceed during final cleaning and concrete placement on adjacent portions of the deck, provided the removal does not interfere in any way with the cleaning or placement operations.

If water or contaminants from the hydro-scarification flow into the area of final cleaning or concrete placement, hydro-scarification shall be suspended until the concrete has been placed and 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.

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) Wetted Cotton Mat Method except that the cotton mats may be pre-dampened to minimize adhesion of the cotton mats to the overlay. 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.

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) unless permitted by the Engineer.

(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, and at a time determined by the Engineer. 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 areas of mechanical and/or hydro scarification on the bridge deck will be measured for payment in square yards (square meters). No additional payment will be made for multiple passes of the equipment required to achieve the specified scarification depth.

The concrete overlay will be measured for payment in square yards (square meters).

When Bridge Deck Hydro-Scarification is specified, the additional concrete placed with the overlay, required to fill all depressions below the specified thickness will be measured for payment in cubic yards (cubic meters). The volume will be determined by subtracting the theoretical volume of the overlay from the ticketed volume of overlay delivered minus the volume estimated by the Engineer left in the last truck at the end of the overlay placement. The theoretical cubic yard (cubic meter) quantity for the overlay will be determined by multiplying the plan surface area of the overlay times the specified thickness of the overlay.

Basis of Payment. Concrete scarification of the bridge deck using mechanical scarification equipment will be paid for at the contract unit price per square yard (square meter) for CONCRETE BRIDGE DECK SCARIFICATION of the depth specified. Concrete scarification of the bridge deck using hydro-scarification equipment will be paid for at the contract unit price per square yard (square meter) for BRIDGE DECK HYDRO-SCARIFICATION of the depth specified.

Latex concrete overlay will be paid for at the contract unit price per square yard (square meter) for BRIDGE DECK LATEX CONCRETE OVERLAY, of the thickness specified. When hydro-scarification is specified, the additional volume of overlay required to fill all depressions below the specified thickness will be paid for at the Contractor's actual material cost for the latex concrete per cubic yard (cubic meter) plus 15 percent.

When mechanical scarification is specified, additional partial depth patches poured monolithically with the overlay will be paid for at the contract unit price bid per square yard (square meter) for DECK SLAB REPAIR (PARTIAL).

When the Engineer conducts pull-off tests on the overlay 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.

When specified on the plans, the Contractor has the option of choosing the type of overlay. The options will be limited to those specified in the plans and will be paid for at the contract unit price per square yard (square meter) for BRIDGE DECK CONCRETE OVERLAY OPTION, of the thickness specified.

Overlay material placed off the deck in abutment backwalls, and/or other locations will not be measured for payment but will be included in the pay item involved.

REMOVAL OF EXISTING NON COMPOSITE BRIDGE DECKS

Effective: June 21, 2004

Revised: January 1, 2007

Revise the last sentence of Article 501.05 (b) of the Standard Specifications to read:

“Saw cutting directly over the top of beam or girder flanges may be permitted only if shown on the plans. The maximum saw cut depth allowed directly over a flange shall be to the bottom of the top mat of reinforcing steel but shall not exceed half the deck thickness. The Contractor shall provide positive control for controlling the depth of cut into the slab. The Contractor shall provide sawing equipment adequate in size and horsepower to complete the sawing operation.”

STRUCTURAL REPAIR OF CONCRETE

Effective: March 15, 2006

Revised: May 11, 2009

Description. This work shall consist of structurally repairing concrete.

Materials. Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement Concrete (Note 1)	1020
(b) R1 or R2 Mortar (Note2)	
(c) Normal Weight Concrete (Note 3)	
(d) Shotcrete (High Performance) (Note 4)	
(e) Reinforcement Bars	1006.10
(f) Anchor Bolts	1006.09
(g) Water	1002
(h) Curing Compound (Type I)	1022
(i) Cotton Mats	1022.02
(j) Protective Coat	1023.01
(k) Epoxy (Note 5)	1025
(l) Mechanical Bar Splicers (Note 6)	

Note 1. The concrete shall be Class SI, except the cement factor shall be a minimum 6.65 cwt/cu. yd. (395 kg/cu. m), the coarse aggregate shall be a CA 16, and the strength shall be a minimum 4000 psi (27,500 kPa) compressive or 675 psi (4650 kPa) flexural at 14 days. A high range water-reducing admixture shall be used to obtain a 5-7 in. (125-175 mm) slump, but the cement factor shall not be reduced. This cement factor restriction shall also apply if a water-reducing admixture is used.

Note 2. The R1 or R2 mortar shall be from the Department's approved list of Packaged, Dry, Rapid Hardening, Cementitious Materials for Concrete Repairs with coarse aggregate added. The amount of coarse aggregate added to the R1 or R2 Mortar shall be per the manufacturer's recommendations. The coarse aggregate gradation shall be CA 16 from an Aggregate Gradation Control System source or a packaged aggregate meeting Article 1004.02 with a maximum size of 1/2 in. (12.5 mm). The R1 or R2 Mortar and coarse aggregate mixture shall comply with the air content and strength requirements for Class SI concrete as indicated in Note 1. Mixing shall be per the manufacturer's recommendations, except the water/cement ratio shall not exceed the value specified for Class SI concrete as indicated in Note 1. A high range water-reducing admixture shall be used to obtain a 5-7 in. (125175 mm) slump.

Note 3. The packaged concrete mixture shall be from the Department's approved list of Packaged, Dry, Formed, Concrete Repair Mixtures. The materials and preparation of aggregate shall be according to ASTM C 387. Proportioning shall be according to ASTM C 387, except the minimum cement factor shall be 6.65 cwt/cu. yd. (395 kg/cu. m). Cement replacement with fly ash or ground granulated blast-furnace slag shall be according to Section 1020. The coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm). The packaged concrete mixture shall comply with the air content and strength requirements for Class SI concrete as indicated in Note 1. Mixing shall be per the manufacturer's recommendations, except the water/cement ratio shall not exceed the value specified for Class SI concrete as indicated in Note 1. A high range water-reducing admixture shall be used to obtain a 5-7 in. (125-175 mm) slump.

Note 4. A packaged, pre-blended, and dry combination of materials, for the wet-mix shotcrete method shall be provided according to ASTM C 1480. An accelerator is prohibited, except the shotcrete may be modified at the nozzle with a non-chloride accelerator for overhead applications. The shotcrete shall be Type FA, Grade FR, and Class I. The fibers shall be Type III synthetic according to ASTM C 1116.

The 7 and 28 day compressive strength requirements in ASTM C 1480 shall not apply. Instead the shotcrete shall obtain a minimum compressive strength of 4000 psi (27,500 kPa) at 14 days.

The packaged shotcrete shall be limited to the following proportions:

The cement and finely divided minerals shall be 6.05 cwt/cu. yd. (360 kg/cu. m) to 7.50 cwt/cu. yd. (445 kg/cu. m), and the cement shall not be below 4.70 cwt/cu. yd. (279 kg/cu. m).

Class F fly ash is optional and the maximum shall be 15 percent by weight (mass) of cement.

Class C fly ash is optional and the maximum shall be 20 percent by weight (mass) of cement.

Ground granulated blast-furnace slag is optional and the maximum shall be 25 percent by weight (mass) of cement.

Microsilica is required and shall be a minimum of 5 percent by weight (mass) of cement, and a maximum of 10 percent. As an alternative to microsilica, high-reactivity metakaolin may be used at a minimum of 5 percent by weight (mass) of cement, and a maximum of 10 percent.

Fly ash shall not be used in combination with ground granulated blast-furnace slag. Class F fly ash shall not be used in combination with Class C fly ash. Microsilica shall not be used in combination with high-reactivity metakaolin. A finely divided mineral shall not be used in combination with a blended hydraulic cement, except for microsilica or high-reactivity metakaolin.

The water/cement ratio shall be a maximum of 0.42.
The air content as shot shall be 4.0 – 8.0 percent.

Note 5. In addition ASTM C 881, Type IV, Grade 2 or 3, Class A, B, or C may be used.

Note 6. Mechanical bar splicers shall be from the approved list of Mechanical Reinforcing Bar Splicers / Coupler Systems, and shall be capable of developing in tension at least 125 percent of the yield strength of the existing reinforcement bar.

Equipment. Equipment shall be according to Article 503.03 and the following.

Chipping Hammer – The chipping hammer for removing concrete shall be a light-duty pneumatic or electric tool with a 15 lb. (7 kg) maximum class or less.

Blast Cleaning Equipment – Blast cleaning equipment for concrete surface preparation shall be the abrasive type, and the equipment shall have oil traps.

Hydrodemolition Equipment – Hydrodemolition equipment for removing concrete shall be calibrated, and shall use water according to Section 1002.

High Performance Shotcrete Equipment – The batching, mixing, pumping, hose, nozzle, and auxiliary equipment shall be for the wet-mix shotcrete method, and shall meet the requirements of ACI 506R.

Construction Requirements

General. The repair methods shall be either formed concrete repair or shotcrete. The repair method shall be selected by the Contractor with the following rules.

- (a) Rule 1. For formed concrete repair, a subsequent patch to repair the placement point after initial concrete placement will not be allowed. As an example, this may occur in a vertical location located at the top of the repair.
- (b) Rule 2. Formed concrete repair shall not be used for overhead applications.
- (c) Rule 3. Shotcrete shall not be used for column repairs greater than 4 in. (100 mm) in depth, or any repair location greater than 8 in. (205 mm) in depth. The only exception to this rule would be for a horizontal application, where the shotcrete may be placed from above in one lift.
- (d) Rule 4. If formed concrete repair is used for locations that have reinforcement with less than 0.75 in. (19 mm) of concrete cover, the concrete mixture shall contain fly ash or ground granulated blast-furnace slag at the maximum cement replacement allowed.

Temporary Shoring or Cribbing. When a temporary shoring or cribbing support system is required, the Contractor shall provide details and computations, prepared and sealed by an Illinois licensed Structural Engineer, to the Department for review and approval. When ever possible the support system shall be installed prior to starting the associated concrete removal.

If no system is specified, but during the course of removal the need for temporary shoring or cribbing becomes apparent or is directed by the Engineer due to a structural concern, the Contractor shall not proceed with any further removal work until an appropriate and approved support system is installed.

Concrete Removal. The Contractor shall provide ladders or other appropriate equipment for the Engineer to mark the removal areas. Repair configurations will be kept simple, and squared corners will be preferred. The repair perimeter shall be sawed a depth of 1/2 in. (13 mm) or less, as required to avoid cutting the reinforcement. Any cut reinforcement shall be repaired or replaced at the expense of the Contractor. If the concrete is broken or removed beyond the limits of the initial saw cut, the new repair perimeter shall be recut. The areas to be repaired shall have all loose, unsound concrete removed completely by the use of chipping hammers, hydrodemolition equipment, or other methods approved by the Engineer. The concrete removal shall extend along the reinforcement bar until the reinforcement is free of bond inhibiting corrosion. The outermost layer of reinforcement bar within the repair area shall be undercut to a depth of 3/4 in. (19 mm) or the diameter of the reinforcement bar, whichever value is larger. The underlying transverse reinforcement bar shall also be undercut as previously described, unless the reinforcement is not corroded, and the reinforcement bar is encased and well bonded to the surrounding concrete.

If sound concrete is encountered before existing reinforcement bars are exposed, further removal of concrete shall not be performed unless the minimum repair depth is not met. The repair depth shall be a minimum of 1 in. (25 mm). The substrate profile shall be $\pm 1/16$ in. (± 1.5 mm). The perimeter of the repair area shall have a vertical face.

If a repair is located at the ground line, any excavation required below the ground line to complete the repair shall be included in this work.

The Contractor shall have a maximum of 14 calendar days to complete each repair location with concrete or shotcrete, once concrete removal has started for the repair.

The Engineer shall be notified of concrete removal that exceeds 6 in. (150 mm) in depth, one fourth the cross section of a structural member, more than half the vertical column reinforcement is exposed in a cross section, more than 6 consecutive reinforcement bars are exposed in any direction, within 1.5 in. (38 mm) of a bearing area, or other structural concern.

Excessive deterioration or removal may require further evaluation of the structure or installation of temporary shoring and cribbing support system.

Surface Preparation. Prior to placing the concrete or shotcrete, the Contractor shall prepare the repair area and exposed reinforcement by blast cleaning. The blast cleaning shall provide a surface that is free of oil, dirt, and loose material.

If a succeeding layer of shotcrete is to be applied, the initial shotcrete surface and remaining exposed reinforcement shall be free of curing compound, oil, dirt, loose material, rebound (i.e. shotcrete material leaner than the original mixture which ricochets off the receiving surface), and overspray. Preparation may be by lightly brushing or blast cleaning if the previous shotcrete surface is less than 36 hours old. If more than 36 hours old, the surface shall be prepared by blast cleaning.

The repair area and perimeter vertical face shall have a rough surface. Care shall be taken to ensure the perimeter sawcut is roughened. Just prior to concrete or shotcrete placement, saturate the repair area with water to a saturated surface-dry condition. Any standing water shall be removed.

Concrete or shotcrete placement shall be done within 3 calendar days of the surface preparation or the repair area shall be prepared again.

Reinforcement. Exposed reinforcement bars shall be cleaned of concrete and corrosion by blast cleaning. After cleaning, all exposed reinforcement shall be carefully evaluated to determine if replacement or additional reinforcement bars are required.

Reinforcing bars that have been cut or have lost 25 percent or more of their original cross sectional area shall be supplemented by new in kind reinforcement bars. New bars shall be lapped a minimum of 32 bar diameters to existing bars. A mechanical bar splicer shall be used when it is not feasible to provide the minimum bar lap. No welding of bars shall be performed.

Intersecting reinforcement bars shall be tightly secured to each other using 0.006 in. (1.6 mm) or heavier gauge tie wire, and shall be adequately supported to minimize movement during concrete placement or application of shotcrete.

For reinforcement bar locations with less than 0.75 in. (19 mm) of cover, protective coat shall be applied to the completed repair. The application of the protective coat shall be according to Article 503.19, 2nd paragraph, except blast cleaning shall be performed to remove curing compound.

The Contractor shall anchor the new concrete to the existing concrete with 3/4 in. (19 mm) diameter hook bolts for all repair areas where the depth of concrete removal is greater than 8 in. (205 mm) and there is no existing reinforcement extending into the repair area. The hook bolts shall be spaced at 15 in. (380 mm) maximum centers both vertically and horizontally, and shall be a minimum of 12 in. (305 mm) away from the perimeter of the repair. The hook bolts shall be installed according to Section 584.

Repair Methods. All repair areas shall be inspected and approved by the Engineer prior to placement of the concrete or application of the shotcrete.

- (a) Formed Concrete Repair. Falsework shall be according to Article 503.05. Forms shall be according to Article 503.06. Formwork shall provide a smooth and uniform concrete finish, and shall approximately match the existing concrete structure. Formwork shall be mortar tight and closely fitted where they adjoin the existing concrete surface to prevent leakage. Air vents may be provided to reduce voids and improve surface appearance. The Contractor may use exterior mechanical vibration, as approved by the Engineer, to release air pockets that may be entrapped.

The concrete for formed concrete repair shall be a Class SI Concrete, or a packaged R1 or R2 Mortar with coarse aggregate added, or a packaged Normal Weight Concrete at the Contractor's option. The concrete shall be placed and consolidated

according to Article 503.07. The concrete shall not be placed when frost is present on the surface of the repair area, or the surface temperature of the repair area is less than 40 °F (4 °C). All repaired members shall be restored as close as practicable to their original dimensions.

Curing shall be done according to Article 1020.13.

If temperatures below 45°F (7°C) are forecast during the curing period, protection methods shall be used. Protection Method I according to Article 1020.13(d)(1), or Protection Method II according to Article 1020.13(d)(2) shall be used during the curing period.

The surfaces of the completed repair shall be finished according to Article 503.15.

- (b) Shotcrete. Shotcrete shall be tested by the Engineer for air content according to Illinois Modified AASHTO T 152. Obtain the sample in a damp, non-absorbent container from the discharge end of the nozzle.

For compressive strength of shotcrete, a 18 x 18 x 3.5 in. (457 x 457 x 89 mm) test panel shall be shot by the Contractor for testing by the Engineer. A steel form test panel shall have a minimum thickness of 3/16 in. (5 mm) for the bottom and sides. A wood form test panel shall have a minimum 3/4 in. (19 mm) thick bottom, and a minimum 1.5 in. (38 mm) thickness for the sides. The test panel shall be cured according to Article 1020.13 (a) (3) or (5) while stored at the jobsite and during delivery to the laboratory. After delivery to the laboratory for testing, curing and testing shall be according to ASTM C 1140.

The method of alignment control (i.e. ground wires, guide strips, depth gages, depth probes, and formwork) to ensure the specified shotcrete thickness and reinforcing bar cover is obtained shall be according to ACI 506R. Ground wires shall be removed after completion of cutting operations. Guide strips and formwork shall be of dimensions and a configuration that do not prevent proper application of shotcrete. Metal depth gauges shall be cut 1/4 in. (6 mm) below the finished surface. All repaired members shall be restored as close as practicable to their original dimensions.

For air temperature limits when applying shotcrete in cold weather, the first paragraph of Article 1020.14(b) shall apply. For hot weather, shotcrete shall not be applied when the air temperature is greater than 90°F (32°C). The applied shotcrete shall have a minimum temperature of 50°F (10°C) and a maximum temperature of 90°F (32°C). The shotcrete shall not be applied during periods of rain unless protective covers or enclosures are installed. The shotcrete shall not be applied when frost is present on the surface of the repair area, or the surface temperature of the repair area is less than 40°F (4°C). If necessary, lighting shall be provided to provide a clear view of the shooting area.

The shotcrete shall be applied according to ACI 506R, and shall be done in a manner that does not result in cold joints, laminations, sandy areas, voids, sags, or separations. In addition, the shotcrete shall be applied in a manner that results in maximum densification of the shotcrete. Shotcrete which is identified as being unacceptable while still plastic shall be removed and re-applied.

The nozzle shall normally be at a distance of 2 to 5 ft. (0.6 to 1.5 m) from the receiving surface, and shall be oriented at right angles to the receiving surface. Exceptions to this requirement will be permitted to fill corners, encase large diameter reinforcing bars, or as approved by the Engineer. For any exception, the nozzle shall never be oriented more than 45 degrees from the surface. Care shall be taken to keep the front face of the reinforcement bar clean during shooting operations. Shotcrete shall be built up from behind the reinforcement bar. Accumulations of rebound and overspray shall be continuously removed prior to application of new shotcrete. Rebound material shall not be incorporated in the work.

Whenever possible, shotcrete shall be applied to the full thickness in a single layer. The maximum thickness shall be 4 in. (100 mm) unless the shotcrete is applied from above on a horizontal surface, or a thicker application is approved by the Engineer. When two or more layers are required, the minimum number shall be used and shall be done in a manner without sagging or separation. A flash coat (i.e. a thin layer of up to 1/4 in. (6 mm) applied shotcrete) may be used as the final lift for overhead applications.

Prior to application of a succeeding layer of shotcrete, the initial layer of shotcrete shall be prepared according to the surface preparation and reinforcement bar cleaning requirements. Upon completion of the surface preparation and reinforcement bar treatment, water shall be applied according to the surface preparation requirements unless the surface is moist. The second layer of shotcrete shall then be applied within 30 minutes.

Shotcrete shall be cut back to line and grade using trowels, cutting rods, screeds or other suitable devices. The shotcrete shall be allowed to stiffen sufficiently before cutting. Cutting shall not cause cracks or delaminations in the shotcrete. For depressions, cut material may be used for small areas. Rebound material shall not be incorporated in the work. For the final finish, a wood float shall be used to approximately match the existing concrete texture. All repaired members shall be restored as close as practicable to their original dimensions.

Contractor operations for curing shall be continuous with shotcrete placement and finishing operations. The Engineer may require modification of operations to ensure satisfactory results are obtained. Cotton mats shall be applied according to Article 1020.13(a)(5) except the exposed layer of shotcrete shall be covered within 10 minutes after finishing, and wet curing shall begin immediately. As an alternative to this method, Type I curing compound shall be applied according to Article 1020.13(a)(4) within 10 minutes and moist curing with cotton mats shall begin within 3 hours. For overhead applications where the final shotcrete layer has been applied, the Contractor has the option to use Type I curing compound in lieu of the cotton mats. Note 5 of the Index Table in Article 1020.13 shall apply to the membrane curing method. The curing compound shall be applied according to Article 1020.13(a)(4).

When a shotcrete layer is to be covered by a succeeding shotcrete layer within 36 hours, the repair area shall be protected with intermittent hand fogging, or wet curing with either burlap or cotton mats shall begin within 10 minutes. Intermittent hand fogging may be used only for the first hour. Thereafter, wet curing with burlap or cotton mats shall be

used until the succeeding shotcrete layer is applied. Intermittent hand fogging may be extended to the first hour and a half if the succeeding shotcrete layer is applied by the end of this time.

The curing period shall be for 7 days, except when there is a succeeding layer of shotcrete. In this instance, the initial shotcrete layer shall be cured until the surface preparation and reinforcement bar treatment is started.

If temperatures below 45°F (7°C) are forecast during the curing period, protection methods shall be used. Protection Method I according to Article 1020.13(d)(1), or Protection Method II according to Article 1020.13(d)(2) shall be used during the curing period

Inspection of Completed Work. The Contractor shall provide ladders or other appropriate equipment for the Engineer to inspect the repaired areas. After curing but no sooner than 28 days after placement of concrete or shooting of shotcrete, the repair shall be examined for conformance with original dimensions, cracks, voids, and delaminations. Sounding for delaminations will be done with a hammer or by other methods determined by the Engineer.

The repaired area shall be removed and replaced, as determined by the Engineer, for nonconformance with original dimensions, surface cracks greater than 0.01 in. (0.25 mm) in width, map cracking with a crack spacing in any direction of 18 in. (0.45 m) or less, voids, or delaminations.

If a nonconforming repair is allowed to remain in place, cracks 0.01 in. (0.25 mm) or less shall be repaired with epoxy according to Section 590. For cracks less than 0.007 in. (2 mm), the epoxy may be applied to the surface of the crack. Voids shall be repaired according to Article 503.15.

Publications and Personnel Requirements. The Contractor shall provide a current copy of ACI 506R to the Engineer a minimum of one week prior to start of construction.

The shotcrete personnel who perform the work shall have current American Concrete Institute (ACI) nozzle men certification for vertical wet and overhead wet applications, except one individual may be in training. This individual shall be adequately supervised by a certified ACI nozzle men as determined by the Engineer. A copy of the nozzle men certificate(s) shall be given to the Engineer.

Method of Measurement. This work will be measured for payment in place and the area computed in square feet (square meters). For a repair at a corner, both sides will be measured.

Basis of Payment. This work will be paid for at the contract unit price per square foot (square meter) for STRUCTURAL REPAIR OF CONCRETE (DEPTH GREATER THAN 5 IN. (125 MM), STRUCTURAL REPAIR OF CONCRETE (DEPTH EQUAL TO OR LESS THAN 5 IN. (125 MM).

When not specified to be paid for elsewhere, the work to design, install, and remove the temporary shoring and cribbing will be paid for according to Article 109.04.

With the exception of reinforcement damaged by the Contractor during removal, the furnishing and installation of supplemental reinforcement bars, mechanical bar splicers, hook bolts, and protective coat will be paid according to Article 109.04.

Payment for the Fiber Optic Splice item shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

ALKALI-SILICA REACTION FOR CAST-IN-PLACE CONCRETE (BDE)

Effective: August 1, 2007

Revised: January 1, 2009

Description. This special provision is intended to reduce the risk of a deleterious alkali-silica reaction in concrete exposed to humid or wet conditions. The special provision is not intended or adequate for concrete exposed to potassium acetate, potassium formate, sodium acetate or sodium formate. The special provision shall not apply to the dry environment (humidity less than 60 percent) found inside buildings for residential or commercial occupancy. The special provision shall also not apply to precast products or precast prestressed products.

Aggregate Expansion Values. Each coarse and fine aggregate will be tested by the Department for alkali reaction according to ASTM C 1260. The test will be performed with Type I or II cement having a total equivalent alkali content ($Na_2O + 0.658K_2O$) of 0.90 percent or greater. The Engineer will determine the assigned expansion value for each aggregate, and these values will be made available on the Department's Alkali-Silica Potential Reactivity Rating List. The Engineer may differentiate aggregate based on ledge, production method, gradation number, or other factors. An expansion value of 0.05 percent will be assigned to limestone or dolomite coarse aggregates and 0.03 percent to limestone or dolomite fine aggregates (manufactured stone sand); however the Department reserves the right to perform the ASTM C 1260 test.

Aggregate Groups. Each combination of aggregates used in a mixture will be assigned to an aggregate group. The point at which the coarse aggregate and fine aggregate expansion values intersect in the following table will determine the group.

AGGREGATE GROUPS			
Coarse Aggregate or Coarse Aggregate Blend ASTM C 1260 Expansion	Fine Aggregate or Fine Aggregate Blend ASTM C 1260 Expansion		
	≤ 0.16%	> 0.16% - 0.27%	> 0.27%
≤ 0.16%	Group I	Group II	Group III
> 0.16% - 0.27%	Group II	Group II	Group III
> 0.27%	Group III	Group III	Group IV

Mixture Options. Based upon the aggregate group, the following mixture options shall be used; however, the Department may prohibit a mixture option if field performance shows a deleterious alkali-silica reaction or Department testing indicates the mixture may experience a deleterious alkali-silica reaction.

- Group I - Mixture options are not applicable. Use any cement or finely divided mineral.
- Group II - Mixture options 1, 2, 3, 4, or 5 shall be used.
- Group III - Mixture options 1, 2 and 3 combined, 4, or 5 shall be used.
- Group IV - Mixture options 1, 2 and 4 combined, or 5 shall be used.

For Class PP-3 concrete the mixture options are not applicable, and any cement may be used with the specified finely divided minerals.

- a) Mixture Option 1. The coarse or fine aggregates shall be blended to place the material in a group that will allow the selected cement or finely divided mineral to be used.

When a coarse or fine aggregate is blended, the weighted expansion value shall be calculated separately for the coarse and fine aggregate as follows:

$$\text{Weighted Expansion Value} = (a/100 \times A) + (b/100 \times B) + (c/100 \times C) + \dots$$

Where: a, b, c... = percentage of aggregate in the blend;
A, B, C...= expansion value for that aggregate.

- b) Mixture Option 2. A finely divided mineral shall be used as described in 1), 2), 3), or 4) that follow. The replacement ratio is defined as “finely divided mineral:portland cement”.

- 1) Class F Fly Ash. For Class PV, BS, MS, DS, SC, and SI concrete and cement aggregate mixture II (CAM II), Class F fly ash shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.

- 2) Class C Fly Ash. For Class PV, MS, SC, and SI Concrete, Class C fly ash with 18 percent to less than 26.5 percent calcium oxide content, and less than 2.0 percent loss on ignition, shall replace 20 percent of the portland cement at a minimum replacement ratio of 1:1; or at a minimum replacement ratio of 1.25:1 if the loss on ignition is 2.0 percent or greater. Class C fly ash with less than 18 percent calcium oxide content shall replace 20 percent of the portland cement at a minimum replacement ratio of 1.25:1.

For Class PP-1, RR, BS, and DS concrete and CAM II, Class C fly ash with less than 26.5 percent calcium oxide content shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.

- 3) Ground Granulated Blast-Furnace Slag. For Class PV, BS, MS, SI, DS, and SC concrete, ground granulated blast-furnace slag shall replace 25 percent of the portland cement at a minimum replacement ratio of 1:1.

For Class PP-1 and RR concrete, ground granulated blast-furnace slag shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.

For Class PP-2, ground granulated blast-furnace slag shall replace 25 to 30 percent of the portland cement at a minimum replacement ratio of 1:1.

- 4) Microsilica or High Reactivity Metakaolin. Microsilica solids or high reactivity metakaolin shall be added to the mixture at a minimum 25 lb/cu yd (15 kg/cu m) or 27 lb/cu yd (16 kg/cu m) respectively.
- c) Mixture Option 3. The cement used shall have a maximum total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.60 percent. When aggregate in Group II is involved, any finely divided mineral may be used with a portland cement.
- d) Mixture Option 4. The cement used shall have a maximum total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.45 percent. When aggregate in Group II or III is involved, any finely divided mineral may be used with a portland cement.
- e) Mixture Option 5. The proposed cement or finely divided mineral may be used if the ASTM C 1567 expansion value is ≤ 0.16 percent when performed on the aggregate in the concrete mixture with the highest ASTM C 1260 test result. The ASTM C 1567 test will be valid for two years, unless the Engineer determines the materials have changed significantly. For latex concrete, the ASTM C 1567 test shall be performed without the latex. The 0.20 percent autoclave expansion limit in ASTM C 1567 shall not apply.

If during the two year time period the Contractor needs to replace the cement, and the replacement cement has an equal or lower total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$), a new ASTM C 1567 test will not be required.

Testing. If an individual aggregate has an ASTM C 1260 expansion value > 0.16 percent, an ASTM C 1293 test may be performed by the Contractor to evaluate the Department's ASTM C 1260 test result. The ASTM C 1293 test shall be performed with Type I or II cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.80 percent or greater. The interior vertical wall of the ASTM C 1293 recommended container (pail) shall be half covered with a wick of absorbent material consisting of blotting paper. If the testing laboratory desires to use an alternate container or wick of absorbent material, ASTM C 1293 test results with an alkali-reactive aggregate of known expansion characteristics shall be provided to the Engineer for review and approval. If the expansion is less than 0.040 percent after one year, the aggregate will be assigned an ASTM C 1260 expansion value of 0.08 percent that will be valid for two years, unless the Engineer determines the aggregate has changed significantly.

The Engineer reserves the right to verify a Contractor's ASTM C 1293 or 1567 test result. The Engineer will not accept the result if the precision and bias for the test methods are not met.

The laboratory performing the ASTM C 1567 test shall either be accredited by the AASHTO Materials Reference Laboratory (AMRL) for ASTM C 227 under Portland Cement Concrete or Aggregate; or shall be inspected for Hydraulic Cement - Physical Tests by the Cement and Concrete Reference Laboratory (CCRL) and shall be approved by the Department. The laboratory performing the ASTM C 1293 test shall be inspected for Portland Cement Concrete by CCRL and shall be approved by the Department.

ALKALI-SILICA REACTION FOR PRECAST AND PRECAST PRESTRESSED CONCRETE (BDE)

Effective: January 1, 2009

Description. This special provision is intended to reduce the risk of a deleterious alkali-silica reaction in precast and precast prestressed concrete exposed to humid or wet conditions. The special provision is not intended or adequate for concrete exposed to potassium acetate, potassium formate, sodium acetate or sodium formate. The special provision shall not apply to the dry environment (humidity less than 60 percent) found inside buildings for residential or commercial occupancy. The special provision shall also not apply to cast-in-place concrete.

Aggregate Expansion Values. Each coarse and fine aggregate will be tested by the Department for alkali reaction according to ASTM C 1260. The test will be performed with Type I or II cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.90 percent or greater. The Engineer will determine the assigned expansion value for each aggregate, and these values will be made available on the Department's Alkali-Silica Potential Reactivity Rating List. The Engineer may differentiate aggregate based on ledge, production method, gradation number, or other factors. An expansion value of 0.05 percent will be assigned to limestone or dolomite coarse aggregates and 0.03 percent to limestone or dolomite fine aggregates (manufactured stone sand); however the Department reserves the right to perform the ASTM C 1260 test.

Aggregate Groups. Each combination of aggregates used in a mixture will be assigned to an aggregate group. The point at which the coarse aggregate and fine aggregate expansion values intersect in the following table will determine the group.

AGGREGATE GROUPS			
Coarse Aggregate or Coarse Aggregate Blend ASTM C 1260 Expansion	Fine Aggregate or Fine Aggregate Blend ASTM C 1260 Expansion		
	$\leq 0.16\%$	$> 0.16\% - 0.27\%$	$> 0.27\%$
$\leq 0.16\%$	Group I	Group II	Group III
$> 0.16\% - 0.27\%$	Group II	Group II	Group III
$> 0.27\%$	Group III	Group III	Group IV

Mixture Options. Based upon the aggregate group, the following mixture options shall be used; however, the Department may prohibit a mixture option if field performance shows a deleterious alkali-silica reaction or Department testing indicates the mixture may experience a deleterious alkali-silica reaction.

- Group I - Mixture options are not applicable. Use any cement or finely divided mineral.
- Group II - Mixture options 1, 2, 3, 4, or 5 shall be used.
- Group III - Mixture options 1, 2 and 3 combined, 4, or 5 shall be used.
- Group IV - Mixture options 1, 2 and 4 combined, or 5 shall be used.

- a) Mixture Option 1. The coarse or fine aggregates shall be blended to place the material in a group that will allow the selected cement or finely divided mineral to be used.

When a coarse or fine aggregate is blended, the weighted expansion value shall be calculated separately for the coarse and fine aggregate as follows:

$$\text{Weighted Expansion Value} = (a/100 \times A) + (b/100 \times B) + (c/100 \times C) + \dots$$

Where: a, b, c... = percentage of aggregate in the blend;
A, B, C... = expansion value for that aggregate.

- b) Mixture Option 2. A finely divided mineral shall be used as described in 1), 2), 3), or 4) that follow. The replacement ratio is defined as “finely divided mineral:portland cement”.
- 1) Class F Fly Ash. For Class PC concrete, precast products, and PS concrete, Class F fly ash shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.
 - 2) Class C Fly Ash. For Class PC Concrete, precast products, and Class PS concrete, Class C fly ash with 18 percent to less than 26.5 percent calcium oxide content, and less than 2.0 percent loss on ignition, shall replace 20 percent of the portland cement at a minimum replacement ratio of 1:1; or at a minimum replacement ratio of 1.25:1 if the loss on ignition is 2.0 percent or greater. Class C fly ash with less than 18 percent calcium oxide content shall replace 20 percent of the portland cement at a minimum replacement ratio of 1.25:1.
 - 3) Ground Granulated Blast-Furnace Slag. For Class PC concrete, precast products, and Class PS concrete, ground granulated blast-furnace slag shall replace 25 percent of the portland cement at a minimum replacement ratio of 1:1.
 - 4) Microsilica or High Reactivity Metakaolin. Microsilica solids or high reactivity metakaolin shall be added to the mixture at a minimum 25 lb/cu yd (15 kg/cu m) or 27 lb/cu yd (16 kg/cu m) respectively.
- c) Mixture Option 3. The cement used shall have a maximum total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.60 percent. When aggregate in Group II is involved, any finely divided mineral may be used with a portland cement.
- d) Mixture Option 4. The cement used shall have a maximum total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.45 percent. When aggregate in Group II or III is involved, any finely divided mineral may be used with a portland cement.
- e) Mixture Option 5. The proposed cement or finely divided mineral may be used if the ASTM C 1567 expansion value is ≤ 0.16 percent when performed on the aggregate in the concrete mixture with the highest ASTM C 1260 test result. The ASTM C 1567 test will be valid for two years, unless the Engineer determines the materials have changed significantly. The 0.20 percent autoclave expansion limit in ASTM C 1567 shall not apply.

If during the two year time period the Contractor needs to replace the cement, and the replacement cement has an equal or lower total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$), a new ASTM C 1567 test will not be required.

Testing. If an individual aggregate has an ASTM C 1260 expansion value > 0.16 percent, an ASTM C 1293 test may be performed by the Contractor to evaluate the Department's ASTM C 1260 test result. The ASTM C 1293 test shall be performed with Type I or II cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.80 percent or greater. The interior vertical wall of the ASTM C 1293 recommended container (pail) shall be half covered with a wick of absorbent material consisting of blotting paper. If the testing laboratory desires to use an alternate container or wick of absorbent material, ASTM C 1293 test results with an alkali-reactive aggregate of known expansion characteristics shall be provided to the Engineer for review and approval. If the expansion is less than 0.040 percent after one year, the aggregate will be assigned an ASTM C 1260 expansion value of 0.08 percent that will be valid for two years, unless the Engineer determines the aggregate has changed significantly.

The Engineer reserves the right to verify a Contractor's ASTM C 1293 or 1567 test result. The Engineer will not accept the result if the precision and bias for the test methods are not met.

The laboratory performing the ASTM C 1567 test shall either be accredited by the AASHTO Materials Reference Laboratory (AMRL) for ASTM C 227 under Portland Cement or Aggregate; or shall be inspected for Hydraulic Cement - Physical Tests by the Cement and Concrete Reference Laboratory (CCRL) and shall be approved by the Department. The laboratory performing the ASTM C 1293 test shall be inspected for Portland Cement Concrete by CCRL and shall be approved by the Department.

APPROVAL OF PROPOSED BORROW AREAS, USE AREAS, AND/OR WASTE AREAS INSIDE ILLINOIS STATE BORDERS (BDE)

Effective: November 1, 2008

Revise the title of Article 107.22 of the Standard Specifications to read:

"107.22 Approval of Proposed Borrow Areas, Use Areas, and/or Waste Areas Inside Illinois State Borders."

Add the following sentence to the end of the first paragraph of Article 107.22 of the Standard Specifications:

"Proposed borrow areas, use areas, and/or waste areas outside of Illinois shall comply with Article 107.01."

CEMENT (BDE)

Effective: January 1, 2007

Revised: April 1, 2009

Revise Section 1001 of the Standard Specifications to read:

"SECTION 1001. CEMENT

1001.01 Cement Types. Cement shall be according to the following.

- (a) Portland Cement. Acceptance of portland cement shall be according to the current Bureau of Materials and Physical Research's Policy Memorandum, "Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants".

Portland cement shall be according to ASTM C 150, and shall meet the standard physical and chemical requirements. Type I or Type II may be used for cast-in-place, precast, and precast prestressed concrete. Type III may be used according to Article 1020.04, or when approved by the Engineer. All other cements referenced in ASTM C 150 may be used when approved by the Engineer.

The total of all organic processing additions shall be a maximum of 1.0 percent by weight (mass) of the cement. The total of all inorganic processing additions shall be a maximum of 4.0 percent by weight (mass) of the cement. However, a cement kiln dust inorganic processing addition shall be limited to a maximum of 1.0 percent. Organic processing additions shall be limited to grinding aids that improve the flowability of cement, reduce pack set, and improve grinding efficiency. Inorganic processing additions shall be limited to granulated blast-furnace slag according to the chemical requirements of AASHTO M 302, Class C fly ash according to the chemical requirements of AASHTO M 295, and cement kiln dust.

- (b) Portland-Pozzolan Cement. Acceptance of portland-pozzolan cement shall be according to the current Bureau of Materials and Physical Research's Policy Memorandum, "Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants".

Portland-pozzolan cement shall be according to ASTM C 595 and shall meet the standard physical and chemical requirements. Type IP may be used for cast-in-place, precast, and precast prestressed concrete, except when Class PP concrete is used. The pozzolan constituent for Type IP shall be a maximum of 21 percent of the weight (mass) of the portland-pozzolan cement.

For cast-in-place construction, portland-pozzolan cement shall not be used in concrete mixtures when the air temperature is below 40 °F (4 °C) without permission of the Engineer. If permission is given, the mix design strength requirement may require the Contractor to increase the cement or eliminate the cement factor reduction for a water-reducing or high range water-reducing admixture which is permitted according to Article 1020.05(b).

The total of all organic processing additions shall be a maximum of 1.0 percent by weight (mass) of the cement. Organic processing additions shall be limited to grinding aids as defined in (a) above. Inorganic processing additions shall be limited to cement kiln dust at a maximum of 1.0 percent.

- (c) Portland Blast-Furnace Slag Cement. Acceptance of portland blast-furnace slag cement shall be according to the current Bureau of Materials and Physical Research's Policy Memorandum, "Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants".

Portland blast-furnace slag cement shall be according to ASTM C 595 and shall meet the standard physical and chemical requirements. Type IS portland blast-furnace slag cement may be used for cast-in-place, precast, and precast prestressed concrete, except when Class PP concrete is used. The blast-furnace slag constituent for Type IS shall be a maximum of 25 percent of the weight (mass) of the portland blast-furnace slag cement.

For cast-in-place construction, portland blast-furnace slag cement shall not be used in concrete mixtures when the air temperature is below 40 °F (4 °C) without permission of the Engineer. If permission is given, the mix design strength requirement may require the Contractor to increase the cement or eliminate the cement factor reduction for a water-reducing or high range water-reducing admixture which is permitted according to Article 1020.05(b).

The total of all organic processing additions shall be a maximum of 1.0 percent by weight (mass) of the cement. Organic processing additions shall be limited to grinding aids as defined in (a) above. Inorganic processing additions shall be limited to cement kiln dust at a maximum of 1.0 percent.

- (d) Rapid Hardening Cement. Rapid hardening cement shall be used according to Article 1020.04 or when approved by the Engineer. The cement shall be on the Department's current "Approved List of Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs", and shall be according to the following.
- (1) The cement shall have a maximum final set of 25 minutes, according to Illinois Modified ASTM C 191.
 - (2) The cement shall have a minimum compressive strength of 2000 psi (13,800 kPa) at 3.0 hours, 3200 psi (22,100 kPa) at 6.0 hours, and 4000 psi (27,600 kPa) at 24.0 hours, according to Illinois Modified ASTM C 109.
 - (3) The cement shall have a maximum drying shrinkage of 0.050 percent at seven days, according to Illinois Modified ASTM C 596.
 - (4) The cement shall have a maximum expansion of 0.020 percent at 14 days, according to Illinois Modified ASTM C 1038.
 - (5) The cement shall have a minimum 80 percent relative dynamic modulus of elasticity; and shall not have a weight (mass) gain in excess of 0.15 percent or a weight (mass) loss in excess of 1.0 percent, after 100 cycles, according to AASHTO T 161, Procedure B.
- (e) Calcium Aluminate Cement. Calcium aluminate cement shall be used only where specified by the Engineer. The cement shall meet the standard physical requirements for Type I cement according to ASTM C 150, except the time of setting shall not apply. The chemical requirements shall be determined according to ASTM C 114 and shall be as follows: minimum 38 percent aluminum oxide (Al_2O_3), maximum 42 percent calcium oxide (CaO), maximum 1 percent magnesium oxide (MgO), maximum 0.4 percent sulfur trioxide (SO_3), maximum 1 percent loss on ignition, and maximum 3.5 percent insoluble residue.

1001.02 Uniformity of Color. Cement contained in single loads or in shipments of several loads to the same project shall not have visible differences in color.

1001.03 Mixing Brands and Types. Different brands or different types of cement from the same manufacturing plant, or the same brand or type from different plants shall not be mixed or used alternately in the same item of construction unless approved by the Engineer.

1001.04 Storage. Cement shall be stored and protected against damage, such as dampness which may cause partial set or hardened lumps. Different brands or different types of cement from the same manufacturing plant, or the same brand or type from different plants shall be kept separate.”

CONCRETE ADMIXTURES (BDE)

Effective: January 1, 2003

Revised: April 1, 2009

Replace the first paragraph of Article 1020.05(b) of the Standard Specifications to read:

“(b) Admixtures. The use of admixtures to increase the workability or to accelerate the hardening of the concrete will be permitted when approved by the Engineer. Admixture dosages shall result in the mixture meeting the specified plastic and hardened properties. The Department will maintain an Approved List of Corrosion Inhibitors. Corrosion inhibitor dosage rates shall be according to Article 1020.05(b)(12). The Department will also maintain an Approved List of Concrete Admixtures, and an admixture technical representative shall be consulted when determining an admixture dosage from this list. The dosage shall be within the range indicated on the approved list unless the influence by other admixtures, jobsite conditions (such as a very short haul time), or other circumstances warrant a dosage outside the range. The Engineer shall be notified when a dosage is proposed outside the range. To determine an admixture dosage, air temperature, concrete temperature, cement source and quantity, finely divided mineral sources(s) and quantity, influence of other admixtures, haul time, placement conditions, and other factors as appropriate shall be considered. The Engineer may request the Contractor to have a batch of concrete mixed in the lab or field to verify the admixture dosage is correct. An admixture dosage or combination of admixture dosages shall not delay the initial set of concrete by more than one hour. When a retarding admixture is required or appropriate for a bridge deck or bridge deck overlayer pour, the initial set time shall be delayed until the deflections due to the concrete dead load are no longer a concern for inducing cracks in the completed work. However, a retarding admixture shall not be used to further extend the pour time and justify the alteration of a bridge deck pour sequence.

When determining water in admixtures for water/cement ratio, the Contractor shall calculate 70 percent of the admixture dosage as water, except a value of 50 percent shall be used for a latex admixture used in bridge deck latex concrete overlays.”

Revise Section 1021 of the Standard Specifications to read:

“SECTION 1021. CONCRETE ADMIXTURES

1021.01 **General.** Admixtures shall be furnished in liquid form ready for use. The admixtures shall be delivered in the manufacturer's original containers, bulk tank trucks or such containers or tanks as are acceptable to the Engineer. Delivery shall be accompanied by a ticket which clearly identifies the manufacturer and trade name of the material. Containers shall be readily identifiable as to manufacturer and trade name of the material they contain.

Corrosion inhibitors will be maintained on the Department's Approved List of Corrosion Inhibitors. All other concrete admixture products will be maintained on the Department's Approved List of Concrete Admixtures. For the admixture submittal, a report prepared by an independent laboratory accredited by the AASHTO Materials Reference Laboratory (AMRL) for Portland Cement Concrete shall be provided. The report shall show the results of physical tests conducted no more than five years prior to the time of submittal, according to applicable specifications. However, for corrosion inhibitors the ASTM G 109 test information specified in ASTM C 1582 is not required to be from an independent lab. All other information in ASTM C 1582 shall be from an independent lab.

Tests shall be conducted using materials and methods specified on a "test" concrete and a "reference" concrete, together with a certification that no changes have been made in the formulation of the material since the performance of the tests. Per the manufacturer's option, the cement content for all required tests shall either be according to applicable specifications or 5.65 cwt/cu yd (335 kg/cu m). Compressive strength test results for six months and one year will not be required.

Prior to the approval of an admixture, the Engineer reserves the right to request a sample for testing. The test and reference concrete mixtures tested by the Engineer will contain a cement content of 5.65 cwt/cu yd (335 kg/cu m). For freeze-thaw testing, the Department will perform the test according to AASHTO T 161, Procedure B. The flexural strength test will be performed according to AASHTO T 177. If the Engineer decides to test the admixture, the manufacturer shall submit AASHTO T 197 water content and set time test results on the standard cement used by the Department. The test and reference concrete mixture shall contain a cement content of 5.65 cwt/cu yd (335 kg/cu m). The manufacturer may select their lab or an independent lab to perform this testing. The laboratory is not required to be accredited by AASHTO.

The manufacturer shall include in the submittal the following admixture information: the manufacturing range for specific gravity, the midpoint and manufacturing range for residue by oven drying, and the manufacturing range for pH. The submittal shall also include an infrared spectrophotometer trace no more than five years old.

For air-entraining admixtures according to Article 1021.02, the specific gravity allowable manufacturing range shall be established by the manufacturer and the test method shall be according to ASTM C 494. For residue by oven drying and pH, the allowable manufacturing range and test methods shall be according to ASTM C 260.

For admixtures according to Articles 1021.03, 1021.04, 1021.05, 1021.06, and 1021.07, the pH allowable manufacturing range shall be established by the manufacturer and the test method shall be according to ASTM E 70. For specific gravity and residue by oven drying, the allowable manufacturing range and test methods shall be according to ASTM C 494.

When test results are more than seven years old, the manufacturer shall re-submit the infrared spectrophotometer trace and the report prepared by an independent laboratory accredited by AASHTO.

All admixtures, except chloride-based accelerators, shall contain a maximum of 0.3 percent chloride by weight (mass).

Random field samples may be taken by the Department to verify an admixture meets specification. A split sample will be provided to the manufacturer if requested. Admixtures that do not meet specification requirements or an allowable manufacturing range established by the manufacturer shall be replaced with new material.

1021.02 Air-Entraining Admixtures. Air-entraining admixtures shall be according to AASHTO M 154.

1021.03 Retarding and Water-Reducing Admixtures. The admixture shall be according to the following.

- (a) The retarding admixture shall be according to AASHTO M 194, Type B (retarding) or Type D (water-reducing and retarding).
- (b) The water-reducing admixture shall be according to AASHTO M 194, Type A.
- (c) The high range water-reducing admixture shall be according to AASHTO M 194, Type F (high range water-reducing) or Type G (high range water-reducing and retarding).

1021.04 Accelerating Admixtures. The admixture shall be according to AASHTO M 194, Type C (accelerating) or Type E (water reducing and accelerating).

1021.05 Self-Consolidating Admixtures. The self-consolidating admixture system shall consist of either a high range water-reducing admixture only or a high range water-reducing admixture combined with a separate viscosity modifying admixture. The one or two component admixture system shall be capable of producing a concrete mixture that can flow around reinforcement and consolidate under its own weight without additional effort and without segregation.

The high range water-reducing admixture shall be according to AASHTO M 194, Type F.

The viscosity modifying admixture shall be according to ASTM C 494, Type S (specific performance).

1021.06 Rheology-Controlling Admixture. The rheology-controlling admixture shall be capable of producing a concrete mixture with a lower yield stress that will consolidate easier for slipform applications used by the Contractor. The rheology-controlling admixture shall be according to ASTM C 494, Type S (specific performance).

1021.07 Corrosion Inhibitor. The corrosion inhibitor shall be according to one of the following.

- (a) Calcium Nitrite. The corrosion inhibitor shall contain a minimum 30 percent calcium nitrite by weight (mass) of solution, and shall comply with the requirements of AASHTO M 194, Type C (accelerating).
- (b) Other Materials. The corrosion inhibitor shall be according to ASTM C 1582.”

CONCRETE MIX DESIGNS (BDE)

Effective: April 1, 2009

Add the following to Article 1020.05(c) of the Standard Specifications:

- “(5) Performance Based Finely Divided Mineral Combination. For Class PV and SI concrete a performance based finely divided mineral combination may be used. The minimum cement factor, maximum cement factor, and water cement ratio of Article 1020.04 shall be replaced with the values below, and the performance based finely divided mineral combination herein is an alternative to Articles 1020.05(c)(1), (c)(2), (c)(3), and (c)(4). The mix design shall meet the following requirements and the Engineer may request a trial batch.
- a. The mixture shall contain a minimum of 375 lbs/cu yd (222 kg/cu m) of portland cement. For a blended cement, a sufficient amount shall be used to obtain the required 375 lbs/cu yd (222 kg/cu m) of portland cement in the mixture. For example, a blended cement stated to have 20 percent finely divided mineral, ignoring any ASTM C 595 tolerance on the 20 percent, would require a minimum of 469 lbs/cu yd (278 kg/cu m) of material in the mixture. When the mixture is designed for cement content from 375 lbs/cu yd (222 kg/cu m) to 400 lbs/cu yd (237 kg/cu m), the total of organic processing additions, inorganic processing additions, and limestone addition in the cement shall not exceed 5.0 percent.
 - b. The mixture shall contain a maximum of two finely divided minerals. The finely divided mineral in a blended cement shall count toward the total number of finely divided minerals allowed. The finely divided mineral(s) shall constitute a maximum of 35.0 percent of the total cement plus finely divided mineral(s). The fly ash portion shall not exceed 30.0 percent for Class C fly ash or 25.0 percent for Class F fly ash. The Class C and F fly ash combination shall not exceed 30.0 percent. The ground granulated blast-furnace slag portion shall not exceed 35.0 percent. The microsilica or high-reactivity metakaolin portion used together or separately shall not exceed 5.0 percent. The finely divided mineral in the blended cement shall apply to the maximum 35.0 percent, and shall be determined as discussed in a. above for determining portland cement in blended cement.
 - c. For central mixed Class PV and SI concrete, the mixture shall contain a minimum of 535 lbs/cu yd (320 kg/cu m) of cement and finely divided mineral(s) summed together, and a water-reducing admixture shall be used.

The value shall be 565 lbs/cu yd (335 kg/cu m) without a water-reducing admixture.

For truck mixed or shrink mixed Class PV and SI concrete, the mixture shall contain a minimum of 575 lbs/cu yd (345 kg/cu m) of cement and finely divided mineral(s) summed together, and a water-reducing admixture shall be used. The value shall be 605 lbs/cu yd (360 kg/cu m) without a water-reducing admixture.

- d. The mixture shall contain a maximum of 705 lbs/cu yd (418 kg/cu m) of cement and finely divided mineral(s) summed together.
- e. The mixture shall have a water/cement ratio of 0.32 – 0.44.
- f. The mixture shall not be used for placement underwater.
- g. The combination of cement and finely divided mineral(s) shall have an ASTM C 1567 expansion value ≤ 0.16 percent, and shall be performed on the aggregate in the concrete mixture with the highest ASTM C 1260 test result. The ASTM C 1567 test will be valid for two years, unless the Engineer determines the materials have changed significantly.

If during the two year time period the Contractor needs to replace the portland cement, and the replacement portland cement has an equal or lower total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$), a new ASTM C 1567 test will not be required. However, replacement of a blended cement with another cement will require a new ASTM C 1567 test.”

CONSTRUCTION AIR QUALITY - DIESEL VEHICLE EMISSIONS CONTROL (BDE)

Effective: April 1, 2009

Revised: July 1, 2009

Diesel Vehicle Emissions Control. The reduction of construction air emissions shall be accomplished by using cleaner burning diesel fuel. The term “equipment” refers to any and all diesel fuel powered devices rated at 50 hp and above, to be used on the project site in excess of seven calendar days over the course of the construction period on the project site (including any “rental” equipment).

All equipment on the jobsite, with engine ratings of 50 hp and above, shall be required to: use Ultra Low Sulfur Diesel fuel (ULSD) exclusively (15 ppm sulfur content or less).

Diesel powered equipment in non-compliance will not be allowed to be used on the project site, and is also subject to a notice of non-compliance as outlined below.

The Contractor shall submit copies of monthly summary reports and include certified copies of the ULSD diesel fuel delivery slips for diesel fuel delivered to the jobsite for the reporting time period, noting the quantity of diesel fuel used.

If any diesel powered equipment is found to be in non-compliance with any portion of this specification, the Engineer will issue the Contractor a notice of non-compliance and identify an appropriate period of time, as outlined below under environmental deficiency deduction, in which to bring the equipment into compliance or remove it from the project site.

Any costs associated with bringing any diesel powered equipment into compliance with these diesel vehicle emissions controls 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 also not be grounds for a claim.

Environmental Deficiency Deduction. When the Engineer is notified, or determines that an environmental control deficiency exists, he/she will notify the Contractor in writing, and direct the Contractor to correct the deficiency within a specified time period. The specified time-period, which begins upon Contractor notification, will be from 1/2 hour to 24 hours long, based on the urgency of the situation and the nature of the deficiency. The Engineer shall be the sole judge regarding the time period.

The deficiency will be based on lack of repair, maintenance and diesel vehicle emissions control.

If the Contractor fails to correct the deficiency within the specified time frame, 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.

If a Contractor or subcontractor accumulates three environmental deficiency deductions 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 contract time, waiver of penalties, or be grounds for any claim.

CONSTRUCTION AIR QUALITY - IDLING RESTRICTIONS (BDE)

Effective: April 1, 2009

Idling Restrictions. The Contractor shall establish truck-staging areas for all diesel powered vehicles that are waiting to load or unload material at the jobsite. Staging areas shall be located where the diesel emissions from the equipment will have a minimum impact on adjacent sensitive receptors. The Department will review the selection of staging areas, whether within or outside the existing highway right-of-way, to avoid locations near sensitive areas or populations to the extent possible. Sensitive receptors include, but are not limited to, hospitals, schools, residences, motels, hotels, daycare facilities, elderly housing and convalescent facilities. Diesel powered engines shall also be located as far away as possible from fresh air intakes, air conditioners, and windows. The Engineer will approve staging areas before implementation.

Diesel powered vehicle operators may not cause or allow the motor vehicle, when it is not in motion, to idle for more than a total of 10 minutes within any 60 minute period, except under any of the following circumstances:

- 1) The motor vehicle has a gross vehicle weight rating of less than 8000 lb (3630 kg).
- 2) The motor vehicle idles while forced to remain motionless because of on-highway traffic, an official traffic control device or signal, or at the direction of a law enforcement official.
- 3) The motor vehicle idles when operating defrosters, heaters, air conditioners, or other equipment solely to prevent a safety or health emergency.
- 4) A police, fire, ambulance, public safety, other emergency or law enforcement motor vehicle, or any motor vehicle used in an emergency capacity, idles while in an emergency or training mode and not for the convenience of the vehicle operator.
- 5) The primary propulsion engine idles for maintenance, servicing, repairing, or diagnostic purposes if idling is necessary for such activity.
- 6) A motor vehicle idles as part of a government inspection to verify that all equipment is in good working order, provided idling is required as part of the inspection.
- 7) When idling of the motor vehicle is required to operate auxiliary equipment to accomplish the intended use of the vehicle (such as loading, unloading, mixing, or processing cargo; controlling cargo temperature; construction operations, lumbering operations; oil or gas well servicing; or farming operations), provided that this exemption does not apply when the vehicle is idling solely for cabin comfort or to operate non-essential equipment such as air conditioning, heating, microwave ovens, or televisions.
- 8) When the motor vehicle idles due to mechanical difficulties over which the operator has no control.
- 9) The outdoor temperature is less than 32 °F (0 °C) or greater than 80 °F (26 °C).

When the outdoor temperature is greater than or equal to 32 °F (0 °C) or less than or equal to 80 °F (26 °C), a person who operates a motor vehicle operating on diesel fuel shall not cause or allow the motor vehicle to idle for a period greater than 30 minutes in any 60 minute period while waiting to weigh, load, or unload cargo or freight, unless the vehicle is in a line of vehicles that regularly and periodically moves forward.

The above requirements do not prohibit the operation of an auxiliary power unit or generator set as an alternative to idling the main engine of a motor vehicle operating on diesel fuel.

Environmental Deficiency Deduction. When the Engineer is notified, or determines that an environmental control deficiency exists based on non-compliance with the idling restrictions, he/she will notify the Contractor, and direct the Contractor to correct the deficiency.

If the Contractor fails to correct the deficiency a monetary deduction will be imposed. The monetary deduction will be \$1,000.00 for each deficiency identified.

DETERMINATION OF THICKNESS (BDE)

Effective: April 1, 2009

Revise Articles 353.12 and 353.13 of the Standard Specifications to Articles 353.13 and 353.14 respectively.

Add the following Article to the Standard Specifications:

“353.12 Tolerance in Thickness. The thickness of base course pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction, bike paths, and individual locations less than 500 ft (150 m) long, will be evaluated. Temporary construction is defined as those areas constructed and removed under the same contract. If the base course cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s), and subtract them from the measured core thickness to determine the base course thickness.

The procedure described in Article 407.10(b) will be followed, except the option of correcting deficient pavement with additional lift(s) shall not apply.”

Revise Article 354.09 of the Standard Specifications to read:

“354.09 Tolerance in Thickness. The thickness of base course widening pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction; bike paths and individual locations less than 3 ft (1 m) wide or 1000 ft (300 m) long, will be evaluated. Temporary construction is defined as those areas constructed and removed under the same contract. If the base course widening cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s), and subtract them from the measured core thickness to determine the base course widening thickness.

The procedure described in Article 407.10(b) will be followed, except:

(a) The width of a unit shall be the width of the widening along one edge of the pavement.

(b) The length of the unit shall be 1000 ft (300 m).

(c) The option of correcting deficient pavement with additional lift(s) shall not apply.”

Revise Article 355.09 of the Standard Specifications to read:

“355.09 Tolerance in Thickness. The thickness of HMA base course pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction; bike paths and individual locations less than 500 ft (150 m) long, will be evaluated according to Article 407.10(b). Temporary construction is defined as those areas constructed and removed under the same contract. If the base course cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s), and subtract them from the measured core thickness to determine the base course thickness.”

Revise Article 356.07 of the Standard Specifications to read:

“356.07 Tolerance in Thickness. The thickness of HMA base course widening pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction; bike paths and individual locations less than 3 ft (1 m) wide or 1000 ft (300 m) long, will be evaluated according to Article 407.10(b) except, the width of a unit shall be the width of the widening along one edge of the pavement and the length of a unit shall be 1000 ft

(300 m). Temporary locations are defined as those constructed and removed under the same contract. If the base course widening cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s) and subtract them from the measured core thickness to determine the base course widening thickness.”

Revise Article 407.10 of the Standard Specifications to read:

“407.10 Tolerance in Thickness. Determination of pavement thickness shall be performed after the pavement surface tests and corrective action have been completed according to Article 407.09. Pay adjustments made for pavement thickness will be in addition to and independent of those made for pavement smoothness. Pavement pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous pavement shall be evaluated with the following exclusions: temporary pavements; variable width pavements; radius returns; short lengths of contiguous pavements less than 500 ft (125 m) in length; and constant width portions of turn lanes less than 500 ft (125 m) in length. Temporary pavements are defined as pavements constructed and removed under the same contract.

The method described in Article 407.10(a), shall be used except for those pavements constructed in areas where access to side streets and entrances necessitates construction in segments less than 1000 ft (300 m). The method described in Article 407.10(b) shall be used in areas where access to side streets and entrances necessitates construction in segments less than 1000 ft (300 m).

(a) Percent Within Limits. The percent within limits (PWL) method shall be as follows.

- (1) Lots and Sublots. The pavement will be divided into approximately equal lots of not more than 5000 ft (1500 m) in length. When the length of a continuous strip of pavement is 500 ft (150 m) or greater but less than 5000 ft (1500 m), these short lengths of pavement, ramps, turn lanes, and other short sections of continuous pavement will be grouped together to form lots approximately 5000 ft (1500 m) in length. Short segments between structures will be measured continuously with the structure segments omitted. Each lot will be subdivided into ten equal sublots. The width of a sublot and lot will be the width from the pavement edge to the adjacent lane line, from one lane line to the next, or between pavement edges for single-lane pavements.
- (2) Cores. Cores 2 in. (50 mm) in diameter shall be taken from the pavement by the Contractor, at locations selected by the Engineer. The exact location for each core will be selected at random, but will result in one core per sublot. Core locations will be specified prior to beginning the coring operations.

The Contractor and the Engineer shall witness the coring operations, as well as the measuring and recording of the core lengths. The cores will be measured with a device supplied by the Department immediately upon removal from the core bit and prior to moving to the next core location. Upon concurrence of the length, the core samples shall be disposed of according to Article 202.03.

Upon completion of each core, all water shall be removed from the hole and the hole then filled with a rapid hardening mortar or concrete. The material shall be mixed in a separate container, placed in the hole, consolidated by rodding, and struck-off flush with the adjacent pavement.

- (3) Deficient Sublot. When the length of the core in a sublot is deficient by more than ten percent of plan thickness, the Contractor may take three additional cores within that sublot at locations selected at random by the Engineer. If the Contractor chooses not to take additional cores, the pavement in that sublot shall be removed and replaced.

When the three additional cores are taken, the length of those cores will be averaged with the original core length. If the average shows the sublot to be deficient by ten percent or less, no additional action is necessary. If the average shows the sublot to be deficient by more than ten percent, the pavement in that sublot shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such deficient sublots to remain in place. For deficient sublots allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When a deficient sublot is removed and replaced, or additional lifts are placed, the corrected sublot shall be retested for thickness. The length of the new core taken in the sublot will be used in determining the PWL for the lot.

When a deficient sublot is left in place, and no additional lift(s) are placed, no payment will be made for the deficient sublot. The length of the original core taken in the sublot will be used in determining the PWL for the lot.

- (4) Deficient Lot. After addressing deficient sublots, the PWL for each lot will be determined. When the PWL of a lot is 60 percent or less, the pavement in that lot shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such deficient lots to remain in place. For deficient lots allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When a deficient lot is removed and replaced, or additional lifts are placed, the corrected lot shall be retested for thickness. The PWL for the lot will then be recalculated based upon the new cores; however, the pay factor for the lot shall be a maximum of 100 percent.

When a deficient lot is left in place, and no additional lift(s) are placed, the PWL for the lot will not be recalculated.

- (5) Right of Discovery. When the Engineer has reason to believe the random core selection process will not accurately represent the true conditions of the work, he/she may order additional cores. The additional cores shall be taken at specific locations determined by the Engineer. The Engineer will provide notice to the Contractor containing an explanation of the reasons for his/her action. The need for, and location of, additional cores will be determined prior to commencement of coring operations.

When the additional cores show the pavement to be deficient by more than ten percent of plan thickness, more additional cores shall be taken to determine the limits of the deficient pavement and that area shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such areas of deficient pavement to remain in place. The area of deficient pavement will be defined using the length between two acceptable cores and the full width of the subplot. An acceptable core is a core with a length of at least 90 percent of plan thickness.

For deficient areas allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When an area of deficient pavement is removed and replaced, or additional lifts are placed, the corrected pavement shall be retested for thickness.

When an area of deficient pavement is left in place, and no additional lift(s) are placed, no payment will be made for the deficient pavement.

When the additional cores show the pavement to be at least 90 percent of plan thickness, the additional cores will be paid for according to Article 109.04.

- (6) Profile Index Adjustment. After any area of pavement is removed and replaced or any additional lifts are placed, the corrected areas shall be retested for pavement smoothness and any necessary profile index adjustments and/or corrections will be made based on these final profile readings prior to retesting for thickness.

- (7) Determination of PWL. The PWL for each lot will be determined as follows.

Definitions:

x_i = Individual values (core lengths) under consideration
 n = Number of individual values under consideration (10 per lot)
 \bar{x} = Average of the values under consideration
LSL = Lower Specification Limit (98% of plan thickness)
 Q_L = Lower Quality Index
 s = Sample Standard Deviation
PWL = Percent Within Limits

Determine \bar{x} for the lot to the nearest two decimal places.

Determine s for the lot to the nearest three decimal places using:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}} \quad \text{where} \quad \sum(x_i - \bar{x})^2 = (x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_{10} - \bar{x})^2$$

Determine Q_L for the lot to the nearest two decimal places using:

$$Q_L = \frac{(\bar{x} - LSL)}{s}$$

Determine PWL for the lot using the Q_L and the following table. For Q_L values less than zero the value shown in the table must be subtracted from 100 to obtain PWL.

- (8) Pay Factors. The pay factor (PF) for each lot will be determined, to the nearest two decimal places, using:

$$PF \text{ (in percent)} = 55 + 0.5 (PWL)$$

If \bar{x} for a lot is less than the plan thickness, the maximum PF for that lot shall be 100 percent.

- (9) Payment. Payment of incentive or disincentive for pay items subject to the PWL method will be calculated using:

$$\text{Payment} = (((TPF/100)-1) \times CUP) \times (TOTPAVT - DEFPAVT)$$

TPF = Total Pay Factor

CUP = Contract Unit Price

TOTPAVT = Area of Pavement Subject to Coring

DEFPAVT = Area of Deficient Pavement

The TPF for the pavement shall be the average of the PF for all the lots; however, the TPF shall not exceed 102 percent.

Area of Deficient pavement (DEFPAVT) is defined as an area of pavement represented by a subplot deficient by more than ten percent which is left in place with no additional thickness added.

Area of Pavement Subject to Coring (TOTPAVT) is defined as those pavement areas included in lots for pavement thickness determination.

PERCENT WITHIN LIMITS							
Quality Index (Q _L)*	Percent Within Limits (PWL)	Quality Index (Q _L)*	Percent Within Limits (PWL)	Quality Index (Q _L)*	Percent Within Limits (PWL)	Quality Index (Q _L)*	Percent Within Limits (PWL)
0.00	50.00	0.40	65.07	0.80	78.43	1.20	88.76
0.01	50.38	0.41	65.43	0.81	78.72	1.21	88.97
0.02	50.77	0.42	65.79	0.82	79.02	1.22	89.17
0.03	51.15	0.43	66.15	0.83	79.31	1.23	89.38
0.04	51.54	0.44	66.51	0.84	79.61	1.24	89.58
0.05	51.92	0.45	66.87	0.85	79.90	1.25	89.79
0.06	52.30	0.46	67.22	0.86	80.19	1.26	89.99
0.07	52.69	0.47	67.57	0.87	80.47	1.27	90.19
0.08	53.07	0.48	67.93	0.88	80.76	1.28	90.38
0.09	53.46	0.49	68.28	0.89	81.04	1.29	90.58
0.10	53.84	0.50	68.63	0.90	81.33	1.30	90.78
0.11	54.22	0.51	68.98	0.91	81.61	1.31	90.96
0.12	54.60	0.52	69.32	0.92	81.88	1.32	91.15
0.13	54.99	0.53	69.67	0.93	82.16	1.33	91.33
0.14	55.37	0.54	70.01	0.94	82.43	1.34	91.52
0.15	55.75	0.55	70.36	0.95	82.71	1.35	91.70
0.16	56.13	0.56	70.70	0.96	82.97	1.36	91.87
0.17	56.51	0.57	71.04	0.97	83.24	1.37	92.04
0.18	56.89	0.58	71.38	0.98	83.50	1.38	92.22
0.19	57.27	0.59	71.72	0.99	83.77	1.39	92.39
0.20	57.65	0.60	72.06	1.00	84.03	1.40	92.56
0.21	58.03	0.61	72.39	1.01	84.28	1.41	92.72
0.22	58.40	0.62	72.72	1.02	84.53	1.42	92.88
0.23	58.78	0.63	73.06	1.03	84.79	1.43	93.05
0.24	59.15	0.64	73.39	1.04	85.04	1.44	93.21
0.25	59.53	0.65	73.72	1.05	85.29	1.45	93.37
0.26	59.90	0.66	74.04	1.06	85.53	1.46	93.52
0.27	60.28	0.67	74.36	1.07	85.77	1.47	93.67
0.28	60.65	0.68	74.69	1.08	86.02	1.48	93.83
0.29	61.03	0.69	75.01	1.09	86.26	1.49	93.98
0.30	61.40	0.70	75.33	1.10	86.50	1.50	94.13
0.31	61.77	0.71	75.64	1.11	86.73	1.51	94.27
0.32	62.14	0.72	75.96	1.12	86.96	1.52	94.41
0.33	62.51	0.73	76.27	1.13	87.20	1.53	94.54
0.34	62.88	0.74	76.59	1.14	87.43	1.54	94.68
0.35	63.25	0.75	76.90	1.15	87.66	1.55	94.82
0.36	63.61	0.76	77.21	1.16	87.88	1.56	94.95
0.37	63.98	0.77	77.51	1.17	88.10	1.57	95.08
0.38	64.34	0.78	77.82	1.18	88.32	1.58	95.20
0.39	64.71	0.79	78.12	1.19	88.54	1.59	95.33

*For Q_L values less than zero, subtract the table value from 100 to obtain PWL

PERCENT WITHIN LIMITS (continued)					
Quality Index (Q _L)*	Percent Within Limits (PWL)	Quality Index (Q _L)*	Percent Within Limits (PWL)	Quality Index (Q _L)*	Percent Within Limits (PWL)
1.60	95.46	2.00	98.83	2.40	99.89
1.61	95.58	2.01	98.88	2.41	99.90
1.62	95.70	2.02	98.92	2.42	99.91
1.63	95.81	2.03	98.97	2.43	99.91
1.64	95.93	2.04	99.01	2.44	99.92
1.65	96.05	2.05	99.06	2.45	99.93
1.66	96.16	2.06	99.10	2.46	99.94
1.67	96.27	2.07	99.14	2.47	99.94
1.68	96.37	2.08	99.18	2.48	99.95
1.69	96.48	2.09	99.22	2.49	99.95
1.70	96.59	2.10	99.26	2.50	99.96
1.71	96.69	2.11	99.29	2.51	99.96
1.72	96.78	2.12	99.32	2.52	99.97
1.73	96.88	2.13	99.36	2.53	99.97
1.74	96.97	2.14	99.39	2.54	99.98
1.75	97.07	2.15	99.42	2.55	99.98
1.76	97.16	2.16	99.45	2.56	99.98
1.77	97.25	2.17	99.48	2.57	99.98
1.78	97.33	2.18	99.50	2.58	99.99
1.79	97.42	2.19	99.53	2.59	99.99
1.80	97.51	2.20	99.56	2.60	99.99
1.81	97.59	2.21	99.58	2.61	99.99
1.82	97.67	2.22	99.61	2.62	99.99
1.83	97.75	2.23	99.63	2.63	100.00
1.84	97.83	2.22	99.66	2.64	100.00
1.85	97.91	2.25	99.68	≥ 2.65	100.00
1.86	97.98	2.26	99.70		
1.87	98.05	2.27	99.72		
1.88	98.11	2.28	99.73		
1.89	98.18	2.29	99.75		
1.90	98.25	2.30	99.77		
1.91	98.31	2.31	99.78		
1.92	98.37	2.32	99.80		
1.93	98.44	2.33	99.81		
1.94	98.50	2.34	99.83		
1.95	98.56	2.35	99.84		
1.96	98.61	2.36	99.85		
1.97	98.67	2.37	99.86		
1.98	98.72	2.38	99.87		
1.99	98.78	2.39	99.88		

*For Q_L values less than zero, subtract the table value from 100 to obtain PWL

(b) Minimum Thickness. The minimum thickness method shall be as follows.

- (1) Length of Units. The length of a unit will be a continuous strip of pavement 500 ft (150 m) in length.
- (2) Width of Units. The width of a unit will be the width from the pavement edge to the adjacent lane line, from one lane line to the next, or between pavement edges for single-lane pavements.
- (3) Thickness Measurements. Pavement thickness will be based on 2 in. (50 mm) diameter cores.

Cores shall be taken from the pavement by the Contractor at locations selected by the Engineer. When determining the thickness of a unit, one core shall be taken in each unit.

The Contractor and the Engineer shall witness the coring operations, as well as the measuring and recording of the cores. Core measurements will be determined immediately upon removal from the core bit and prior to moving to the next core location. Upon concurrence of the length, the core samples may be disposed of according to Article 202.03.

Upon completion of each core, all water shall be removed from the hole and the hole then filled with a rapid hardening mortar or concrete. The material shall be mixed in a separate container, placed in the hole, consolidated by rodding, and struck-off flush with the adjacent pavement.

- (4) Unit Deficient in Thickness. In considering any portion of the pavement that is deficient, the entire limits of the unit will be used in computing the deficiency or determining the remedial action required.
- (5) Thickness Equals or Exceeds Specified Thickness. When the thickness of a unit equals or exceeds the specified plan thickness, payment will be made at the contract unit price per square yard (square meter) for the specified thickness.
- (6) Thickness Deficient by Ten Percent or Less. When the thickness of a unit is less than the specified plan thickness by ten percent or less, a deficiency deduction will be assessed against payment for the item involved. The deficiency will be a percentage of the contract unit price as given in the following table.

Percent Deficiency (of Plan Thickness)	Percent Deduction (of Contract Unit Price)
0.0 to 2.0	0
2.1 to 3.0	20
3.1 to 4.0	28
4.1 to 5.0	32
5.1 to 7.5	43
7.6 to 10.0	50

- (7) Thickness Deficient by More than Ten Percent. When a core shows the pavement to be deficient by more than ten percent of plan thickness, additional cores shall be taken on each side of the deficient core, at stations selected by the Contractor and offsets selected by the Engineer, to determine the limits of the deficient pavement. No core shall be located within 5 ft (1.5 m) of a previous core obtained for thickness determination. The first acceptable core obtained on each side of a deficient core will be used to determine the length of the deficient pavement. An acceptable core is a core with a thickness of at least 90 percent of plan thickness. The area of deficient pavement will be defined using the length between two acceptable cores and the full width of the unit. The area of deficient pavement shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such areas of deficient pavement to remain in place. For deficient areas allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When an area of deficient pavement is removed and replaced, or additional lifts are placed, the corrected pavement shall be retested for thickness. The thickness of the new core will be used to determine the pay factor for the corrected area.

When an area of deficient pavement is left in place, and no additional lift(s) are placed, no payment will be made for the deficient pavement. In addition, an amount equal to two times the contract cost of the deficient pavement will be deducted from the compensation due the Contractor.

The thickness of the first acceptable core on each side of the core more than ten percent deficient will be used to determine any needed pay adjustments for the remaining areas on each side of the area deficient by more than ten percent. The pay adjustment will be determined according to Article 407.10(b)(6).

- (8) Right of Discovery. When the Engineer has reason to believe any core location does not accurately represent the true conditions of the work, he/she may order additional cores. These additional cores shall be taken at specific locations determined by the Engineer. The Engineer will provide notice to the Contractor containing an explanation of the reasons for his/her action.

When the additional cores show the pavement to be deficient by more than ten percent of plan thickness, the procedures outlined in Article 407.10(b)(7) shall be followed, except the Engineer will determine the additional core locations.

When the additional cores, ordered by the Engineer, show the pavement to be at least 90 percent of plan thickness, the additional cores will be paid for according to Article 109.04.

- (9) Profile Index Adjustment. After any area of pavement is removed and replaced or any additional lifts are added, the corrected areas shall be retested for pavement smoothness and any necessary profile index adjustments and/or corrections will be made based on these final profile readings prior to retesting for thickness.”

Revise Article 482.06 of the Standard Specifications to read:

“482.06 Tolerance in Thickness. The shoulder shall be constructed to the thickness shown on the plans. When the contract includes square yards (square meters) as the unit of measurement for HMA shoulder, thickness determinations shall be made according to Article 407.10(b)(3) and the following.

- (a) Length of the Units. The length of a unit shall be a continuous strip of shoulder 2500 ft (750 m) long.
- (b) Width of the Units. The width of the unit shall be the full width of the shoulder.
- (c) Thickness Deficient by More than Ten Percent. When a core shows the shoulder to be deficient by more than ten percent of plan thickness, additional cores shall be taken on each side of the deficient core, at stations selected by the Contractor and offsets selected by the Engineer, to determine the limits of the deficient shoulder. No core shall be located within 5 ft (1.5 m) of a previous core obtained for thickness determination. The first acceptable core obtained on each side of a deficient core will be used to determine the length of the deficient shoulder. An acceptable core is a core with a thickness of at least 90 percent of plan thickness. The area of deficient shoulder will be defined using the length between two acceptable cores and the full width of the unit. The area of deficient shoulder shall be brought to specified thickness by the addition of the applicable mixture, at no additional cost to the Department and subject to the lift thickness requirements of Article 312.05, or by removal and replacement with a new mixture. However, the surface elevation of the completed shoulder shall not exceed by more than 1/8 in. (3 mm) the surface elevation of the adjacent pavement. When requested in writing by the Contractor, the Engineer may permit in writing such thin shoulder to remain in place. When an area of thin shoulder is left in place, and no additional lift(s) are placed, no payment will be made for the thin shoulder. In addition, an amount equal to two times the contract unit price of the shoulder will be deducted from the compensation due the Contractor.

When an area of deficient shoulder is removed and replaced, or additional lifts are placed, the corrected pavement shall be retested for thickness.

- (d) Right of Discovery. When the Engineer has reason to believe any core location does not accurately represent the true conditions of the work, he/she may order additional cores. When the additional cores, ordered by the Engineer, show the shoulder to be at least 90 percent of plan thickness, the additional cores will be paid for according to Article 109.04. When the additional core shows the shoulder to be less than 90 percent of plan thickness, the procedure in (c), above shall be followed.”

Revise Article 483.07 of the Standard Specifications to read:

“483.07 Tolerance in Thickness. The shoulder shall be constructed to the thickness shown on the plans. Thickness determinations shall be made according to Article 482.06 except the option of correcting deficient pavement with additional lift(s) shall not apply.”

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (DBE)

Effective: September 1, 2000

Revised: November 1, 2008

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 or most recent addendum.

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. This 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 **9.0%** 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 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 forth in this Special Provision:

- (a) The bidder documents that firmly committed 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 may 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 web site at www.dot.il.gov.

BIDDING PROCEDURES. Compliance with the bidding procedures of this Special Provision is required prior to the award of the contract and the failure of the as-read low bidder to comply will render the bid not responsive.

- (a) In order to assure the timely award of the contract, the as-read low bidder shall submit a Disadvantaged Business Utilization Plan on Department form SBE 2026 within seven working days after the date of letting. To meet the seven day requirement, the bidder may send the Plan by certified mail or delivery service within the seven working day period. If a question arises concerning the mailing date of a Plan, the mailing date will be established by the U.S. Postal Service postmark on the original certified mail receipt from the U.S. Postal Service or the receipt issued by a delivery service. It is the responsibility of the bidder to ensure that the postmark or receipt date is affixed within the seven working days if the bidder intends to rely upon mailing or delivery to satisfy the submission day requirement. The Plan is to be submitted 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). It is the responsibility of the bidder to obtain confirmation of telefax delivery. The Department will not accept a Utilization Plan if it does not meet the seven day submittal requirement and the bid will be declared not responsive. In the event the bid is declared not responsive due to a failure to submit a Plan or failure to comply with the bidding procedures set forth herein, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty, and may deny authorization to bid the project if re-advertised for bids. The Department reserves the right to invite any other bidder to submit a Utilization Plan at any time for award consideration or to extend the time for award.
- (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. The signatures on these forms must be original signatures. All elements of information indicated on the said form shall be provided, including but not limited to the following:
- (1) The name and address of each DBE to be used;
 - (2) A description, including pay item numbers, of the commercially useful work to be done by each DBE;
 - (3) The price to be paid to each DBE for the identified work specifically stating 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) A commitment statement signed by the bidder and each DBE evidencing availability and intent to perform commercially useful work on the project; and
 - (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).
- (d) The contract will not be awarded until the Utilization Plan submitted by the bidder is approved. The Utilization Plan will be approved by the Department if the Plan commits sufficient commercially useful DBE work performance to meet the contract goal. The Utilization Plan will not be approved by the Department if the Plan does not commit sufficient DBE performance to meet the contract goal unless the bidder documents that it made a good faith effort to meet the goal. The good faith procedures of Section VIII of this special provision apply. If the Utilization Plan is not approved because it is deficient in a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no less than a five working day period in order to cure the deficiency.

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 full value of all such DBE trucks operated using DBE employed drivers. Goal credit will be limited to the value of the reasonable fee or commission received by the DBE if trucks are leased from a non-DBE company.
- (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 or 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.

GOOD FAITH EFFORT PROCEDURES. If the bidder cannot obtain sufficient DBE commitments to meet the contract goal, the bidder must document in the Utilization Plan the good faith efforts made in the attempt 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 could reasonably be expected to obtain sufficient DBE participation. The Department will consider the quality, quantity, and intensity of the kinds of efforts that the bidder has made. Mere *pro forma* efforts are not good faith efforts; rather, the bidder is expected to have taken those 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 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 a good faith effort has not been made, the Department will notify the bidder of that preliminary determination by contacting the responsible company official designated in the Utilization Plan. The preliminary determination shall include a statement of reasons why good faith efforts have not been found, and may include additional good faith efforts that the bidder could take. The notification will designate a five working day period during which the bidder shall take additional efforts. The bidder is not limited by a statement of additional efforts, but may take other action beyond any stated additional efforts in order to obtain additional DBE commitments. The bidder shall submit an amended Utilization Plan if additional DBE commitments to meet the contract goal are secured. If additional DBE commitments sufficient to meet the contract goal are not secured, the bidder shall report the final good faith efforts made in the time allotted. All additional efforts taken by the bidder will be considered as part of the bidder's good faith efforts. If the bidder is not able to meet the goal after taking additional efforts, the Department will make a pre-final determination of the good faith efforts of the bidder and will notify the designated responsible company official of the reasons for an adverse determination.
- (c) The bidder may request administrative reconsideration of a pre-final determination adverse to the bidder within the five working days after 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 pre-final determination shall become final if a request is not made and delivered. A request may provide additional written documentation and/or argument concerning the issue of whether an adequate good faith effort was made to meet the contract goal. In addition, the request shall be considered a consent by the bidder to extend the time for award. 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 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 reconsideration, 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.

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 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.

- (a) 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) All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the Participation Statement. The Contractor shall not terminate for convenience a DBE listed in the Utilization Plan and then perform the work of the terminated DBE with its own forces, those of an affiliate or those of another subcontractor, whether DBE or not, without first obtaining the written consent of the Bureau of Small Business Enterprises to amend the Utilization Plan. If a DBE listed in the Utilization Plan is terminated for reasons other than convenience, or fails to complete its work on the contract for any reason, the Contractor shall make good faith efforts to find another DBE to substitute for the terminated DBE. The good faith efforts shall be directed at finding another DBE to perform at least the same amount of work under the contract as the DBE that was terminated, but only to the extent needed to meet the contract goal or the amended contract goal. The Contractor shall notify the Bureau of Small Business Enterprises of any termination for reasons other than convenience, and shall obtain approval for inclusion of the substitute DBE in the Utilization Plan. If good faith efforts following a termination of a DBE for cause are not successful, the Contractor shall contact the Bureau of Small Business Enterprises and provide a full accounting of the efforts undertaken to obtain substitute DBE participation. The Bureau of Small Business Enterprises will evaluate the good faith efforts in light of all circumstances surrounding the performance status of the contract, and determine whether the contract goal should be amended.
- (c) 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 DBE companies indicated in the Plan, the Department will deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages.

- (d) 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.
- (e) 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.

DOWEL BARS (BDE)

Effective: April 1, 2007

Revised: January 1, 2008

Revise the fifth and sixth sentences of Article 1006.11(b) of the Standard Specifications to read:

"The bars shall be epoxy coated according to AASHTO M 284, except the thickness of the epoxy shall be 7 to 12 mils (0.18 to 0.30 mm) and patching of the ends will not be required. The epoxy coating applicator shall be certified according to the current Bureau of Materials and Physical Research Policy Memorandum, "Epoxy Coating Plant Certification Procedure". The Department will maintain an approved list."

EPOXY PAVEMENT MARKINGS (BDE)

Effective: January 1, 2007

Revise Article 1095.04(a) of the Standard Specifications to read:

- "(a) The epoxy marking material shall consist of a 100 percent solid two part system formulated and designed to provide a simple volumetric mixing ratio of two components (must be two volumes of Part A and one volume of Part B). No volatile solvents or fillers will be allowed. Total solids shall not be less than 99 percent when determined, on the mixed material, according to ASTM D 2369, excluding the solvent dispersion."

Revise Article 1095.04(d) of the Standard Specifications to read:

“(d) Composition by Weight of Component A as Determined by Low Temperature Ashing. A 0.5 gram sample of component A shall be dispersed with a paperclip on the bottom of an aluminum dish, weighed and then heated in a muffle furnace at 1000 °F (538 °C) for one hour and weighed again. No solvents shall be used for dispersion. The difference in the weights shall be calculated and meet the following.

Pigment*	White	Yellow
Titanium Dioxide ASTM D 476 Type II	21-24%	
Organic Yellow, Titanium Dioxide, Other		± 2%**
Epoxy Resin	76-79%	± 2%**

* No extender pigments are permitted.

** From the pigment and epoxy resin content determined on qualification samples.”

Revise Article 1095.04(f) of the Standard Specifications to read:

“(f) The daylight directional reflectance of the paint (without glass spheres) applied at 14 to 16 mils (0.35 to 0.41 mm) shall meet the following requirements when tested, using a color spectrophotometer with 45 degree circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White: Daylight Reflectance 80 % min.

Yellow:* Daylight Reflectance 50 % min.

*Shall meet the coordinates of the following color tolerance chart.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456”

Revise Article 1095.04(h) of the Standard Specifications to read:

“(h) The epoxy pavement marking material, when mixed in the proper mix ratio and tested according to ASTM D 7234 shall have a degree of adhesion which results in a 100 percent concrete failure in the performance of this test.”

Revise Article 1095.04(n) of the Standard Specifications to read:

“(n) The epoxy paint shall be applied to an aluminum alloy panel (Federal Test Std. No. 141, Method 2013) at a film thickness of 14 to 16 mils (0.35 to 0.41 mm) and allowed to cure for 72 hours at room temperature. Subject the coated panel for 75 hours to accelerated weathering using the light and water exposure apparatus (fluorescent UV - condensation type) as specified in ASTM G 53 (equipped with UVB-313 lamps).

The cycle shall consist of four hours UV exposure at 122 °F (50 °C) followed by four hours of condensation at 104 °F (40 °C). UVB 313 bulbs shall be used. At the end of the exposure period, the panel shall show no more than 10 Hunter Lab Delta E units or substantial change in gloss from the original, non-exposed paint.”

EQUIPMENT RENTAL RATES (BDE)

Effective: August 2, 2007

Revised: January 2, 2008

Replace the second and third paragraphs of Article 105.07(b)(4)a. of the Standard Specifications with the following:

“Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).”

Replace Article 109.04(b)(4) of the Standard Specifications with the following:

“(4) Equipment. Equipment used for extra work shall be authorized by the Engineer. The equipment shall be specifically described, be of suitable size and capacity for the work to be performed, and be in good operating condition. For such equipment, the Contractor will be paid as follows.

- a. Contractor Owned Equipment. Contractor owned equipment will be paid for by the hour using the applicable FHWA hourly rate from the “Equipment Watch Rental Rate Blue Book” (Blue Book) in effect when the force account work begins. The FHWA hourly rate is calculated as follows.

$$\text{FHWA hourly rate} = (\text{monthly rate}/176) \times (\text{model year adj.}) \times (\text{Illinois adj.}) + \text{EOC}$$

Where: EOC = Estimated Operating Costs per hour (from the Blue Book)

The time allowed will be the actual time the equipment is operating on the extra work. For the time required to move the equipment to and from the site of the extra work and any authorized idle (standby) time, payment will be made at the following hourly rate: $0.5 \times (\text{FHWA hourly rate} - \text{EOC})$.

All time allowed shall fall within the working hours authorized for the extra work.

The rates above include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs, overhaul and maintenance of any kind, depreciation, storage, overhead, profits, insurance, and all incidentals. The rates do not include labor.

The Contractor shall submit to the Engineer sufficient information for each piece of equipment and its attachments to enable the Engineer to determine the proper equipment category. If a rate is not established in the Blue Book for a particular piece of equipment, the Engineer will establish a rate for that piece of equipment that is consistent with its cost and use in the industry.

- b. Rented Equipment. Whenever it is necessary for the Contractor to rent equipment to perform extra work, the rental and transportation costs of the equipment plus five percent for overhead will be paid. In no case shall the rental rates exceed those of established distributors or equipment rental agencies.

All prices shall be agreed to in writing before the equipment is used.”

HOT-MIX ASPHALT - FIELD VOIDS IN THE MINERAL AGGREGATE (BDE)

Effective: April 1, 2007

Revised: April 1, 2008

Add the following to the table in Article 1030.05(d)(2)a. of the Standard Specifications:

"Parameter	Frequency of Tests	Frequency of Tests	Test Method
	High ESAL Mixture Low ESAL Mixture	All Other Mixtures	See Manual of Test Procedures for Materials
VMA	Day's production ≥ 1200 tons: 1 per half day of production	N/A	Illinois-Modified AASHTO R 35
Note 5.	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)		

Note 5. 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."

Add the following to the Control Limits table in Article 1030.05(d)(4) of the Standard Specifications:

"CONTROL LIMITS			
Parameter	High ESAL Low ESAL	High ESAL Low ESAL	All Other
	Individual Test	Moving Avg. of 4	Individual Test
VMA	-0.7 % ^{2/}	-0.5 % ^{2/}	N/A

^{2/} Allowable limit below minimum design VMA requirement"

Add the following to the table in Article 1030.05(d)(5) of the Standard Specifications:

"CONTROL CHART REQUIREMENTS	High ESAL Low ESAL	All Other
	VMA"	

Revise the heading of Article 1030.05(d)(6)a.1. of the Standard Specifications to read:

"1. Voids, VMA, and Asphalt Binder Content."

Revise the first sentence of the first paragraph of Article 1030.05(d)(6)a.1.(a.) of the Standard Specifications to read:

"If the retest for voids, VMA, or asphalt binder content exceeds control limits, HMA production shall cease and immediate corrective action shall be instituted by the Contractor."

Revise the table in Article 1030.05(e) of the Standard Specifications to read:

“Test Parameter	Acceptable Limits of Precision
% Passing: ^{1/}	
1/2 in. (12.5 mm)	5.0 %
No. 4 (4.75 mm)	5.0 %
No. 8 (2.36 mm)	3.0 %
No. 30 (600 μm)	2.0 %
Total Dust Content No. 200 (75 μm) ^{1/}	2.2 %
Asphalt Binder Content	0.3 %
Maximum Specific Gravity of Mixture	0.026
Bulk Specific Gravity	0.030
VMA	1.4 %
Density (% Compaction)	1.0 % (Correlated)

^{1/} Based on washed ignition.”

HOT-MIX ASPHALT – PLANT TEST FREQUENCY (BDE)

Effective: April 1, 2008

Revise the table in Article 1030.05(d)(2)a. of the Standard Specifications to read:

“Parameter	Frequency of Tests	Frequency of Tests	Test Method See Manual of Test Procedures for Materials
	High ESAL Mixture Low ESAL Mixture	All Other Mixtures	
Aggregate Gradation Hot bins for batch and continuous plants. Individual cold-feed or combined belt- feed for drier drum plants. % 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 dry gradation per day of production (either morning or afternoon sample). and 1 washed ignition oven test on the mix per day of production (conduct in the afternoon if dry gradation is conducted in the morning or vice versa). Note 3. Note 4.	1 gradation per day of production. The first day of production shall be a washed ignition oven test on the mix. Thereafter, the testing shall alternate between dry gradation and washed ignition oven test on the mix. 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
Air Voids Bulk Specific Gravity of Gyrotory Sample	Day's production ≥ 1200 tons: 1 per half day of production	1 per day	Illinois-Modified AASHTO T 312
	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)		
Maximum Specific Gravity of Mixture	Day's production ≥ 1200 tons: 1 per half day of production	1 per day	Illinois-Modified AASHTO T 209"
	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)		

HOT-MIX ASPHALT – TRANSPORTATION (BDE)

Effective: April 1, 2008

Revise Article 1030.08 of the Standard Specifications to read:

“1030.08 Transportation. Vehicles used in transporting HMA shall have clean and tight beds. The beds shall be sprayed with asphalt release agents from the Department’s approved list. In lieu of a release agent, the Contractor may use a light spray of water with a light scatter of manufactured sand (FA 20 or FA 21) evenly distributed over the bed of the vehicle. After spraying, the bed of the vehicle shall be in a completely raised position and it shall remain in this position until all excess asphalt release agent or water has been drained.

When the air temperature is below 60 °F (15 °C), the bed, including the end, endgate, sides and bottom shall be insulated with fiberboard, plywood or other approved insulating material and shall have a thickness of not less than 3/4 in (20 mm). When the insulation is placed inside the bed, the insulation shall be covered with sheet steel approved by the Engineer. Each vehicle shall be equipped with a cover of canvas or other suitable material meeting the approval of the Engineer which shall be used if any one of the following conditions is present.

- (a) Ambient air temperature is below 60 °F (15 °C).
- (b) The weather is inclement.
- (c) The temperature of the HMA immediately behind the paver screed is below 250 °F (120 °C).

The cover shall extend down over the sides and ends of the bed for a distance of approximately 12 in. (300 mm) and shall be fastened securely. The covering shall be rolled back before the load is dumped into the finishing machine.”

IMPACT ATTENUATORS (BDE)

Effective: November 1, 2003

Revised: November 1, 2008

Description. This work shall consist of furnishing and installing impact attenuators of the category and test level specified.

Materials. Materials shall meet the requirements of the impact attenuator manufacturer and the following:

Item	Article/Section
(a) Fine Aggregate (Note 1).....	1003.01
(b) Steel Posts, Structural Shapes, and Plates	1006.04
(c) Rail Elements, End Section Plates, and Splice Plates	1006.25
(d) Bolts, Nuts, Washers and Hardware	1006.25
(e) Hollow Structural Tubing	1006.27(b)
(f) Wood Posts and Wood Blockouts	1007.01, 1007.02, 1007.06
(g) Preservative Treatment.....	1007.12

Note 1. Fine aggregate shall be FA 1 or FA 2, Class A quality. The sand shall be unbagged and shall have a maximum moisture content of five percent.

CONSTRUCTION REQUIREMENTS

General. Impact attenuators shall meet the testing criteria contained in National Cooperative Highway Research Program (NCHRP) Report 350 for the test level specified and shall be on the Department’s approved list. Fully redirective and partially redirective attenuators shall also be designed for bi-directional impacts.

Installation. Regrading of slopes or approaches for the installation shall be as shown on the plans.

Bases for impact attenuators, other than sand modules, shall be installed when required by the manufacturer. The bases shall be constructed on a prepared subgrade according to the manufacturer’s specifications. The surface of the base shall be slightly sloped or crowned to facilitate drainage.

Bases for sand module impact attenuators will be required. The bases shall be constructed of either portland cement concrete or hot-mix asphalt (HMA). Portland cement concrete bases shall be 6 in. (150 mm) thick and be according to the applicable requirements of Section 424 of the Standard Specifications. HMA bases shall be 8 in. (200 mm) thick and be according to the

applicable requirements of Section 408 of the Standard Specifications. The surface of the base shall be slightly sloped or crowned to facilitate drainage. The perimeter of each module and the specified weight (mass) of sand in each module shall be painted on the surface of the base.

Impact attenuators shall be installed according to the manufacturer's specifications and include all necessary transitions between the impact attenuator and the item to which it is attached.

Method of Measurement. This work will be measured for payment as each, where each is defined as one complete installation.

Contract quantities for sand module attenuator bases may be accepted according to Article 202.07(a) of the Standard Specifications. When measured, sand module attenuator bases will be measured in place and the dimensions used to calculate square yards (square meters) will not exceed those as shown on the plans.

Basis of Payment. This work, will be paid for at the contract unit price per each for IMPACT ATTENUATORS (FULLY REDIRECTIVE, NARROW); IMPACT ATTENUATORS (FULLY REDIRECTIVE, WIDE); IMPACT ATTENUATORS (FULLY REDIRECTIVE, RESETTABLE); IMPACT ATTENUATORS (SEVERE USE, NARROW); IMPACT ATTENUATORS (SEVERE USE, WIDE); IMPACT ATTENUATORS (PARTIALLY REDIRECTIVE); or IMPACT ATTENUATORS (NON-REDIRECTIVE), of the test level specified.

Sand module attenuator bases will be paid for at the contract unit price per square yard (square meter) for ATTENUATOR BASE.

Regrading of slopes or approaches will be paid for according to Section 202 and/or Section 204 of the Standard Specifications.

IMPACT ATTENUATORS, TEMPORARY (BDE)

Effective: November 1, 2003

Revised: January 1, 2007

Description. This work shall consist of furnishing, installing, maintaining, and removing temporary impact attenuators of the category and test level specified.

Materials. Materials shall meet the requirements of the impact attenuator manufacturer and the following:

Item	Article/Section
(a) Fine Aggregate (Note 1)	003.01
(b) Steel Posts, Structural Shapes, and Plates	1006.04
(c) Rail Elements, End Section Plates, and Splice Plates	1006.25
(d) Bolts, Nuts, Washers and Hardware	1006.25
(e) Hollow Structural Tubing	1006.27(b)
(f) Wood Posts and Wood Blockouts	1007.01, 1007.02, 1007.06
(g) Preservative Treatment	1007.12
(h) Packaged Rapid Hardening Mortar	1018.01

Note 1. Fine aggregate shall be FA 1 or FA 2, Class A quality. The sand shall be unbagged and shall have a maximum moisture content of five percent.

CONSTRUCTION REQUIREMENTS

General. Impact Attenuators shall meet the testing criteria contained in National Cooperative Highway Research Program (NCHRP) Report 350 for the test level specified and shall be on the Department's approved list.

Installation. Regrading of slopes or approaches for the installation shall be as shown on the plans.

Attenuator bases, when required by the manufacturer, shall be constructed on a prepared subgrade according to the manufacturer's specifications. The surface of the base shall be slightly sloped or crowned to facilitate drainage.

Impact attenuators shall be installed according to the manufacturer's specifications and include all necessary transitions between the impact attenuator and the item to which it is attached.

When water filled attenuators are used between November 1 and April 15, they shall contain anti-freeze according to the manufacturer's recommendations.

Markings. Sand module impact attenuators shall be striped with alternating reflectorized Type AA or Type AP fluorescent orange and reflectorized white horizontal, circumferential stripes. There shall be at least two of each stripe on each module.

Other types of impact attenuators shall have a terminal marker applied to their nose and reflectors along their sides.

Maintenance. All maintenance of the impact attenuators shall be the responsibility of the Contractor until removal is directed by the Engineer.

Relocate. When relocation of temporary impact attenuators is specified, they shall be removed, relocated and reinstalled at the new location. The reinstallation requirements shall be the same as those for a new installation.

Removal. When the Engineer determines the temporary impact attenuators are no longer required, the installation shall be dismantled with all hardware becoming the property of the Contractor.

Surplus material shall be disposed of according to Article 202.03. Anti-freeze, when present, shall be disposed of/recycled according to local ordinances.

When impact attenuators have been anchored to the pavement, the anchor holes shall be repaired with rapid set mortar. Only enough water to permit placement and consolidation by rodding shall be used and the material shall be struck-off flush.

Method of Measurement. This work will be measured for payment as each, where each is defined as one complete installation.

Basis of Payment. This work will be paid for at the contract unit price per each for IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, NARROW); IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, WIDE); IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, RESETTABLE); IMPACT ATTENUATORS, TEMPORARY (SEVERE USE, NARROW); IMPACT ATTENUATORS, TEMPORARY (SEVERE USE, WIDE); or IMPACT ATTENUATORS, TEMPORARY (NON-REDIRECTIVE) of the test level specified.

Relocation of the devices will be paid for at the contract unit price per each for IMPACT ATTENUATORS, RELOCATE (FULLY REDIRECTIVE); IMPACT ATTENUATORS, RELOCATE (SEVERE USE); or IMPACT ATTENUATORS, RELOCATE (NON-REDIRECTIVE); of the test level specified.

Regrading of slopes or approaches will be paid for according to Section 202 and/or Section 204 of the Standard Specifications.

LIQUIDATED DAMAGES (BDE)

Effective: April 1, 2009

Revise the table in Article 108.09 of the Standard Specifications to read:

"Schedule of Deductions for Each Day of Overrun in Contract Time			
Original Contract Amount		Daily Charges	
From More Than	To and Including	Calendar Day	Work Day
\$ 0	\$ 100,000	\$ 375	\$ 500
100,000	500,000	625	875
500,000	1,000,000	1,025	1,425
1,000,000	3,000,000	1,125	1,550
3,000,000	5,000,000	1,425	1,950
5,000,000	10,000,000	1,700	2,350
10,000,000	And over	3,325	4,650"

METAL HARDWARE CAST INTO CONCRETE (BDE)

Effective: April 1, 2008

Revised: April 1, 2009

Add the following to Article 503.02 of the Standard Specifications:

"(g) Metal Hardware Cast into Concrete 1006.13"

Add the following to Article 504.02 of the Standard Specifications:

"(j) Metal Hardware Cast into Concrete 1006.13"

Revise Article 1006.13 of the Standard Specifications to read:

“1006.13 Metal Hardware Cast into Concrete. Unless otherwise noted, all steel hardware cast into concrete, such as inserts, brackets, cable clamps, metal casings for formed holes, and other miscellaneous items, shall be galvanized according to AASHTO M 232 or AASHTO M 111. Aluminum inserts will not be allowed. Zinc alloy inserts shall be according to ASTM B 86, Alloys 3, 5, or 7.

The inserts shall be UNC threaded type anchorages having the following minimum certified proof load.

Insert Diameter	Proof Load
5/8 in. (16 mm)	6600 lb (29.4 kN)
3/4 in. (19 mm)	6600 lb (29.4 kN)
1 in. (25 mm)	9240 lb (41.1 kN)”

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM / EROSION AND SEDIMENT CONTROL DEFICIENCY DEDUCTION (BDE)

Effective: April 1, 2007

Revised: November 1, 2008

Revise Article 105.03(a) of the Standard Specifications to read:

“(a) National Pollutant Discharge Elimination System (NPDES) / Erosion and Sediment Control Deficiency Deduction. When the Engineer is notified or determines an erosion and/or sediment control deficiency(s) exists, or the Contractor’s activities represents a violation of the Department’s NPDES permits, the Engineer will notify and direct the Contractor to correct the deficiency within a specified time. The specified time, which begins upon notification to the Contractor, will be from 1/2 hour to 1 week based on the urgency of the situation and the nature of the work effort required. The Engineer will be the sole judge.

A deficiency may be any lack of repair, maintenance, or implementation of erosion and/or sediment control devices included in the contract, or any failure to comply with the conditions of the Department’s NPDES permits. A deficiency may also be applied to situations where corrective action is not an option such as the failure to participate in a jobsite inspection of the project, failure to install required measures prior to initiating earth moving operations, disregard of concrete washout requirements, or other disregard of the NPDES permit.

If the Contractor fails to correct a deficiency within the specified time, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency exists. The calendar day(s) will begin with notification to the Contractor and end with the Engineer’s acceptance of the correction. The daily monetary deduction will be either \$1000.00 or 0.05 percent of the awarded contract value, whichever is greater. For those deficiencies where corrective action was not an option, the monetary deduction will be immediate and will be valued at one calendar day.”

NIGHTTIME WORK ZONE LIGHTING (BDE)

Effective: November 1, 2008

Description. This work shall consist of furnishing, installing, maintaining, moving, and removing lighting for nighttime work zones. Nighttime shall be defined as occurring shortly before sunset until after sunrise.

Materials. The lighting shall consist of mobile and/or stationary lighting systems as required herein for the specific type of construction. Mobile lighting systems shall consist of luminaires attached to construction equipment or moveable carts. Stationary lighting systems shall consist of roadway luminaires mounted on temporary poles or trailer mounted light towers at fixed locations. Some lighting systems, such as balloon lights, may be adapted to both mobile and stationary applications.

Equipment. The Contractor shall furnish an illuminance meter for use by the Engineer. The meter shall have a digital display calibrated to NIST standards, shall be cosine and color corrected, and shall have an accuracy of \pm five percent. The sensor shall have a level indicator to ensure measurements are taken in a horizontal plane.

CONSTRUCTION REQUIREMENTS

General. At the preconstruction conference, the Contractor shall submit the type(s) of lighting system to be used and the locations of all devices.

Before nighttime construction may begin, the lighting system shall be demonstrated as being operational.

Nighttime Flagging. The requirements for nighttime flagging shall be according to Article 701.13 of the Standard Specifications and the glare control requirements contained herein.

Lighting System Design. The lighting system shall be designed to meet the following.

- (a) Lighting Levels. The lighting system shall provide a minimum of 5 foot candles (54 lux) throughout the work area. For mobile operations, the work area shall be defined as 25 ft (9 m) in front of and behind moving equipment. For stationary operations, the work area shall be defined as the entire area where work is being performed.

Lighting levels will be measured with an illuminance meter. Readings will be taken in a horizontal plane 3 ft (1 m) above the pavement or ground surface.

- (b) Glare Control. The lighting system shall be designed and operated so as to avoid glare that interferes with traffic, workers, or inspection personnel. Lighting systems with flood, spot, or stadium type luminaires shall be aimed downward at the work and rotated outward no greater than 30 degrees from nadir (straight down). Balloon lights shall be positioned at least 12 ft (3.6 m) above the roadway.

As a large component of glare, the headlights of construction vehicles and equipment shall not be operated within the work zone except as allowed for specific construction operations. Headlights shall never be used when facing oncoming traffic.

- (c) Light Trespass. The lighting system shall be designed to effectively light the work area without spilling over to adjoining property. When, in the opinion of the Engineer, the lighting is disturbing adjoining property, the Contractor shall modify the lighting arrangement or add hardware to shield the light trespass.

Construction Operations. The lighting design required above shall be provided at any location where construction equipment is operating or workers are present on foot. When multiple operations are being carried on simultaneously, lighting shall be provided at each separate work area.

The lighting requirements for specific construction operations shall be as follows.

- (a) Installation or Removal of Work Zone Traffic Control. The required lighting level shall be provided at each truck and piece of equipment used during the installation or removal of work zone traffic control. Headlights may be operated in the work zone.
- (b) Milling and Paving. The required lighting level shall be provided by mounting a minimum of one balloon light to each piece of mobile construction equipment used in the work zone. This would include milling machines, mechanical sweepers, material transfer devices, spreading and finishing machines, and rollers; but not include trucks used to transport materials and personnel or other vehicles that are continuously moving in and out of the work zone. The headlights of construction equipment shall not be operated within the work zone.
- (c) Patching. The required lighting level shall be provided at each patching location where work is being performed.
- (d) Pavement Marking and Raised Reflective Pavement Marker Removal/Installation. The striping truck and the attenuator/arrow board trucks may be operated by headlights alone; however, additional lighting may be necessary for the operator of the striping truck to perform the work.

For raised reflective pavement marker removal and installation and other pavement marking operations where workers are on foot, the required lighting level shall be provided at each truck and piece of equipment.

- (e) Layout, Testing, and Inspection. The required lighting level shall be provided for each active area of construction layout, material testing, and inspection. The work area shall be defined as 15 ft (7.6 m) in front and back of the individual(s) performing the tasks.

Basis of Payment. This work will be paid for at the contract lump sum price for NIGHTTIME WORK ZONE LIGHTING.

NOTIFICATION OF REDUCED WIDTH (BDE)

Effective: April 1, 2007

Add the following after the first paragraph of Article 701.06 of the Standard Specifications:

“Where the clear width through a work zone with temporary concrete barrier will be 16.0 ft (4.88 m) or less, the Contractor shall notify the Engineer at least 21 days in advance of implementing the traffic control for that restriction.”

PAVEMENT MARKING REMOVAL (BDE)

Effective: April 1, 2009

Add the following to the end of the first paragraph of Article 783.03(a) of the Standard Specifications:

“The use of grinders will not be allowed on new surface courses.”

PAYMENTS TO SUBCONTRACTORS (BDE)

Effective: June 1, 2000

Revised: January 1, 2006

Federal regulations found at 49 CFR §26.29 mandate the Department to establish a contract clause to require Contractors to pay subcontractors for satisfactory performance of their subcontracts and to set the time for such payments.

State law also addresses the timing of payments to be made to subcontractors and material suppliers. Section 7 of the Prompt Payment Act, 30 ILCS 540/7, requires that when a Contractor receives any payment from the Department, the Contractor shall make corresponding, proportional payments to each subcontractor and material supplier performing work or supplying material within 15 calendar days after receipt of the Department payment. Section 7 of the Act further provides that interest in the amount of two percent per month, in addition to the payment due, shall be paid to any subcontractor or material supplier by the Contractor if the payment required by the Act is withheld or delayed without reasonable cause. The Act also provides that the time for payment required and the calculation of any interest due applies to transactions between subcontractors and lower-tier subcontractors and material suppliers throughout the contracting chain.

This Special Provision establishes the required federal contract clause, and adopts the 15 calendar day requirement of the State Prompt Payment Act for purposes of compliance with the federal regulation regarding payments to subcontractors. This contract is subject to the following payment obligations.

When progress payments are made to the Contractor according to Article 109.07 of the Standard Specifications, the Contractor shall make a corresponding payment to each subcontractor and material supplier in proportion to the work satisfactorily completed by each subcontractor and for the material supplied to perform any work of the contract. The proportionate amount of partial payment due to each subcontractor and material supplier throughout the contracting chain shall be determined by the quantities measured or otherwise

determined as eligible for payment by the Department and included in the progress payment to the Contractor. Subcontractors and material suppliers shall be paid by the Contractor within 15 calendar days after the receipt of payment from the Department. The Contractor shall not hold retainage from the subcontractors. These obligations shall also apply to any payments made by subcontractors and material suppliers to their subcontractors and material suppliers; and to all payments made to lower tier subcontractors and material suppliers throughout the contracting chain. Any payment or portion of a payment subject to this provision may only be withheld from the subcontractor or material supplier to whom it is due for reasonable cause.

This Special Provision does not create any rights in favor of any subcontractor or material supplier against the State or authorize any cause of action against the State on account of any payment, nonpayment, delayed payment, or interest claimed by application of the State Prompt Payment Act. The Department will not approve any delay or postponement of the 15 day requirement except for reasonable cause shown after notice and hearing pursuant to Section 7(b) of the State Prompt Payment Act. State law creates other and additional remedies available to any subcontractor or material supplier, regardless of tier, who has not been paid for work properly performed or material furnished. These remedies are a lien against public funds set forth in Section 23(c) of the Mechanics Lien Act, 770 ILCS 60/23(c), and a recovery on the Contractor's payment bond according to the Public Construction Bond Act, 30 ILCS 550.

PAYROLLS AND PAYROLL RECORDS (BDE)

Effective: March 1, 2009

Revised: July 1, 2009

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 each worker's name, address, telephone number, social security number, classification, rate of pay, number of hours worked each day, starting and ending times of work each day, total hours worked each week, itemized deductions made, and actual wages paid.

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 three years from the date of completion of this contract, records of the wages paid to his/her workers. The payroll records shall include each worker's name, address, telephone number, social security number, classification, rate of pay, number of hours worked each day, starting and ending times of work each day, total hours worked each week, itemized deductions made, and actual wages paid. Upon two business days' notice, these records shall be available, at all reasonable hours at a location within the State, for inspection by the Department or the Department of Labor.
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 which avers that: (i) 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 B 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."

PERSONAL PROTECTIVE EQUIPMENT (BDE)

Effective: November 1, 2008

Revise the first sentence of Article 701.12 of the Standard Specifications to read:

"All personnel on foot, excluding flaggers, within the highway right-of-way shall wear a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 2 garments."

POLYUREA PAVEMENT MARKING (BDE)

Effective: April 1, 2004

Revised: January 1, 2009

Description. This work shall consist of furnishing and applying pavement marking lines.

The type of polyurea pavement marking applied will be determined by the type of reflective media used. Polyurea Pavement Marking Type I shall use glass beads as a reflective media. Polyurea Pavement Marking Type II shall use a combination of composite reflective elements and glass beads as a reflective media.

Polyurea-based liquid pavement markings shall only be applied by Contractors on the list of Approved Polyurea Contractors maintained by the Engineer of Operations and in effect on the date of advertisement for bids.

Materials. Materials shall meet the following requirements:

- (a) Polyurea Pavement Marking. The polyurea pavement marking material shall consist of 100 percent solid two part system formulated and designed to provide a simple volumetric mixing ratio of two components (must be two or three volumes of Part A to one volume of Part B). No volatile or polluting solvents or fillers will be allowed.
- (b) Pigmentation. The pigment content by weight (mass) of component A shall be determined by low temperature ashing according to ASTM D 3723. The pigment content shall not vary more than \pm two percent from the pigment content of the original qualified paint.

White Pigment shall be Titanium Dioxide meeting ASTM D 476 Type II, Rutile.

Yellow Pigment shall be an Organic Yellow and contain no heavy metals.

- (c) Environmental. Upon heating to application temperature, the material shall not exude fumes which are toxic or injurious to persons or property.
- (d) Daylight Reflectance. The daylight directional reflectance of the cured polyurea material (without reflective media) shall be a minimum of 80 percent (white) and 50 percent (yellow) relative to magnesium oxide when tested using a color spectrophotometer with a 45 degrees circumferential /zero degrees geometry, illuminant C, and two degrees observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm. In addition, the color of the yellow polyurea shall visually match Color Number 33538 of Federal Standard 595a with chromaticity limits as follows:

X	0.490	0.475	0.485	0.539
Y	0.470	0.438	0.425	0.456

- (e) Weathering Resistance. The polyurea marking material, when mixed in the proper ratio and applied at 14 to 16 mils (0.35 to 0.41 mm) wet film thickness to an aluminum alloy panel (Federal Test Std. No. 141, Method 2013) and allowed to cure for 72 hours at room

temperature, shall be subjected to accelerated weathering for 75 hours. The accelerated weathering shall be completed by using the light and water exposure apparatus (fluorescent UV - condensation type) and tested according to ASTM G 53.

The cycle shall consist of four hours UV exposure at 122 °F (50 °C) and four hours of condensation at 104 °F (40 °C). UVB 313 bulbs shall be used. At the end of the exposure period, the material shall show no substantial change in color or gloss.

- (f) Dry Time. The polyurea pavement marking material, when mixed in the proper ratio and applied at 14 to 16 mils (0.35 to 0.41 mm) wet film thickness and with the proper saturation of reflective media, shall exhibit a no-tracking time of ten minutes or less when tested according to ASTM D 711.
- (g) Adhesion. The catalyzed polyurea pavement marking materials when applied to a 4 x 4 x 2 in. (100 x 100 x 50 mm) concrete block, shall have a degree of adhesion which results in a 100 percent concrete failure in the performance of this test.

The concrete block shall be brushed on one side and have a minimum strength of 3500 psi (24,100 kPa). A 2 in. (50 mm) square film of the mixed polyurea shall be applied to the brushed surface and allowed to cure for 72 hours at room temperature. A 2 in. (50 mm) square cube shall be affixed to the surface of the polyurea by means of an epoxy glue. After the glue has cured for 24 hours, the polyurea specimen shall be placed on a dynamic testing machine in such a fashion so that the specimen block is in a fixed position and the 2 in. (50 mm) cube (glued to the polyurea surface) is attached to the dynamometer head. Direct upward pressure shall be slowly applied until the polyurea system fails. The location of the break and the amount of concrete failure shall be recorded.

- (h) Hardness. The polyurea pavement marking materials when tested according to ASTM D 2240, shall have a shore D hardness of between 70 and 100. Films shall be cast on a rigid substrate at 14 to 16 mils (0.35 to 0.41 mm) in thickness and allowed to cure at room temperature for 72 hours before testing.
- (i) Abrasion. The abrasion resistance shall be evaluated according to ASTM D 4060 using a Taber Abrader with a 1,000 gram load and CS 17 wheels. The duration of the test shall be 1,000 cycles. The loss shall be calculated by difference and be less than 120 mgs. The tests shall be run on cured samples of polyurea material which have been applied at a film thickness of 14 to 16 mils (0.35 to 0.41 mm) to code S-16 stainless steel plates. The films shall be allowed to cure at room temperature for at least 72 hours and not more than 96 hours before testing.

- (j) Reflective Media. The reflective media shall meet the following requirements:

- (1) Type I - The glass beads shall meet the requirements of Article 1095.07 of the Standard Specifications and the following requirements:

- a. First Drop Glass Beads. The first drop glass beads shall be tested by the standard visual method of large glass spheres adopted by the Department. The beads shall have a silane coating and meet the following sieve requirements:

U.S. Standard Sieve Number	Sieve Size	% Passing By Weight (mass)
12	1.70 mm	95-100
14	1.40 mm	75-95
16	1.18 mm	10-47
18	1.00 mm	0-7
20	850 µm	0-5

b. Second Drop Glass Beads. The second drop glass beads shall meet the requirements of Article 1095.07 of the Standard Specifications for Type B.

(2) Type II - The combination of microcrystalline ceramic elements and glass beads shall meet the following requirements:

a. First Drop Glass Beads. The first drop glass beads shall meet the following requirements:

1. Composition. The elements shall be composed of a titania opacified ceramic core having clear and or yellow tinted microcrystalline ceramic beads embedded to the outer surface.
2. Index of Refraction. All microcrystalline reflective elements embedded to the outer surface shall have an index of refraction of 1.8 when tested by the immersion method.
3. Acid Resistance. A sample of microcrystalline ceramic beads supplied by the manufacturer, shall show resistance to corrosion of their surface after exposure to a one percent solution (by weight (mass)) of sulfuric acid. Adding 0.2 oz (5.7 ml) of concentrated acid into the water shall make the one percent acid solution. This test shall be performed by taking a 1 x 2 in. (25 x 50 mm) sample and adhering it to the bottom of a glass tray and placing just enough acid solution to completely immerse the sample. The tray shall be covered with a piece of glass to prevent evaporation and allow the sample to be exposed for 24 hours under these conditions. The acid solution shall be decanted (do not rinse, touch, or otherwise disturb the bead surfaces) and the sample dried while adhered to the glass tray in a 150 °F (66 °C) oven for approximately 15 minutes. Microscope examination (20X) shall show no white (corroded) layer on the entire surface.

b. Second Drop Glass Beads. The second drop glass beads shall meet the requirements of Article 1095.07 of the Standard Specifications for Type B or the following manufacturer's specification:

1. Sieve Analysis. The glass beads shall meet the following sieve requirements:

U.S. Standard Sieve Number	Sieve Size	% Passing By Weight (mass)
20	850 μm	100
30	600 μm	75-95
50	300 μm	15-35
100	150 μm	0-5

The manufacturer of the glass beads shall certify that the treatment of the glass beads meets the requirements of the polyurea manufacturer.

2. Imperfections. The surface of the glass beads shall be free of pits and scratches. The glass beads shall be spherical in shape and shall contain a maximum of 20 percent by weight (mass) of irregular shapes when tested by the standard method using a vibratile inclined glass plate as adopted by the Department.
 3. Index of Refraction. The index of refraction of the glass beads shall be a minimum of 1.50 when tested by the immersion method at 77 °F (25 °C).
- (k) Packaging. Microcrystalline ceramic reflective elements and glass beads shall be delivered in approved moisture proof bags or weather resistant bulk boxes. Each carton shall be legibly marked with the manufacturer, specifications and type, lot number, and the month and year the microcrystalline ceramic reflective elements and/or glass beads were packaged. The letters and numbers used in the stencils shall be a minimum of 1/2 in. (12.7 mm) in height.
- (1) Moisture Proof Bags. Moisture proof bags shall consist of at least five ply paper construction unless otherwise specified. Each bag shall contain 50 lb (22.7 kg) net.
 - (2) Bulk Weather Resistance Boxes. Bulk weather resistance boxes shall conform to Federal Specification PPP-8-640D Class II or latest revision. Boxes are to be weather resistant, triple wall, fluted, corrugated-fiber board. Cartons shall be strapped with two metal straps. Straps shall surround the outside perimeter of the carton. The first strap shall be located approximately 2 in. (50 mm) from the bottom of the carton and the second strap shall be placed approximately in the middle of the carton. All cartons shall be shrink wrapped for protection from moisture. Cartons shall be lined with a minimum 4 mil polyester bag and meet Interstate Commerce Commission requirements. Cartons shall be approximately 38 x 38 in. (1 x 1 m), contain 2000 lb (910 kg) of microcrystalline ceramic reflective elements and/or glass beads and be supported on a wooden pallet with fiber straps.
- (l) Packaging. The material shall be shipped to the job site in substantial containers and shall be plainly marked with the manufacturer's name and address, the name and color of the material, date of manufacture, and batch number.
- (m) Verification. Prior to approval and use of the polyurea pavement marking materials, the manufacturer shall submit a notarized certification of an independent laboratory, together with the results of all tests, stating these materials meet the requirements as set forth

herein. The certification test report shall state the lot tested, manufacturer's name, brand name of polyurea and date of manufacture. The certification shall be accompanied by one 1 pt (1/2 L) samples each of Part A and Part B. Samples shall be sent in the appropriate volumes for complete mixing of Part A and Part B.

After approval by the Department, certification by the polyurea manufacturer shall be submitted for each batch used. New independent laboratory certified test results and samples for testing by the Department shall be submitted any time the manufacturing process or paint formulation is changed. All costs of testing (other than tests conducted by the Department) shall be borne by the manufacturer.

- (n) Acceptance samples. Acceptance samples shall consist of one 1 pt (1/2 L) samples of Part A and Part B, of each lot of paint. Samples shall be sent in the appropriate volumes for complete mixing of Part A and Part B. The samples shall be submitted to the Department for testing, together with a manufacturer's certification. The certification shall state the formulation for the lot represented is essentially identical to that used for qualification testing. All, acceptance samples will be taken by a representative of the Department. The polyurea pavement marking materials shall not be used until tests are completed and they have met the requirements as set forth herein.
- (o) Material Retainage. The manufacturer shall retain the test sample for a minimum of 18 months.

Equipment. The polyurea pavement marking compounds shall be applied through equipment specifically designed to apply two component liquid materials, glass beads and/or reflective elements in a continuous and skip-line pattern. The two-component liquid materials shall be applied after being accurately metered and then mixed with a static mix tube or airless impingement mixing guns. The static mixing tube or impingement mixing guns shall accommodate plural component material systems that have a volumetric ratio of 2 to 1 or 3 to 1. This equipment shall produce the required amount of heat at the mixing head and gun tip and maintain those temperatures within the tolerances specified. The guns shall have the capacity to deliver materials from approximately 1.5 to 3 gal/min (5.7 to 11.4 L/min) to compensate for a typical range of application speeds of 6 to 8 mph (10 to 13 km/h). The accessories such as spray tip, mix chamber, and rod diameter shall be selected according to the manufacturer's specifications to achieve proper mixing and an acceptable spray pattern. The application equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. This equipment shall also have as an integral part of the gun carriage, a high pressure air spray capable of cleaning the pavement immediately prior to making application.

The equipment shall be capable of spraying both yellow and white polyurea, according to the manufacturer's recommended proportions and be mounted on a truck of sufficient size and stability with an adequate power source to produce lines of uniform dimensions and prevent application failure. The truck shall have at least two polyurea tanks each of 110 gal (415 L) minimum capacity and be equipped with hydraulic systems and agitators. It shall be capable of placing stripes on the left and right sides and placing two lines on a three-line system simultaneously with either line in a solid or intermittent pattern, in yellow or white, and applying the appropriate reflective media according to manufacturer's recommendations. All guns shall

be in full view of operations at all times. The equipment shall have a metering device to register the accumulated installed quantities for each gun, each day. Each vehicle shall include at least one operator who shall be a technical expert in equipment operations and polyurea application techniques. Certification of equipment shall be provided at the pre-construction conference.

The mobile applicator shall include the following features:

- (a) Material Reservoirs. The applicator shall provide individual material reservoirs, or space for the storage of Part A and Part B of the resin composition.
- (b) Heating Equipment. The applicator shall be equipped with heating equipment of sufficient capacity to maintain the individual resin components at the manufacturer's recommended temperature of ± 5 °F (± 2.8 °C) for spray application.
- (c) Dispensing Equipment. The applicator shall be equipped with glass bead and/or reflective element dispensing equipment. The applicator shall be capable of applying the glass beads and/or reflective elements at a rate and combination indicated by the manufacturer.
- (d) Volumetric Usage. The applicator shall be equipped with metering devices or pressure gauges on the proportioning pumps as well as stroke counters to monitor volumetric usage. Metering devices or pressure gauges and stroke counters shall be visible to the Engineer.
- (e) Pavement Marking Placement. The applicator shall be equipped with all the necessary spray equipment, mixers, compressors and other appurtenances to allow for the placement of reflectorized pavement markings in a simultaneous sequence of operations.

The Contractor shall provide an accurate temperature-measuring device(s) that shall be capable of measuring the pavement temperature prior to application of the material, the material temperature at the gun tip and the material temperature prior to mixing.

CONSTRUCTION REQUIREMENTS

General. The pavement shall be cleaned by a method approved by the Engineer to remove all dirt, grease, glaze, or any other material that would reduce the adhesion of the markings with minimum or no damage to the pavement surface. New portland cement concrete pavements shall be air-blast-cleaned to remove all latents.

Widths, lengths, and shapes of the cleaned surface shall be of sufficient size to include the full area of the specified pavement marking to be placed.

The cleaning operation shall be a continuous moving operation process with minimum interruption to traffic.

Markings shall be applied to the cleaned surfaces on the same calendar day. If this cannot be accomplished, the surface shall be re-cleaned prior to applying the markings. No markings shall be applied until the Engineer approves the cleaning.

The pavement markings shall be applied to the cleaned road surface, during conditions of dry weather and subsequently dry pavement surfaces at a minimum uniform wet thickness of 15 mils (0.4 mm) according to the manufacturer's installation instructions. On new hot-mix asphalt (HMA) surfaces the pavement markings shall be applied at a minimum uniform wet thickness of 20 mils (0.5 mm). The application of and combination of reflective media (glass beads and/or reflective elements) shall be applied at a rate specified by the manufacturer. At the time of installation the pavement surface temperature and the ambient temperature shall be above 40 °F (4 °C) and rising. The pavement markings shall not be applied if the pavement shows any visible signs of moisture or it is anticipated that damage causing moisture, such as rain showers, may occur during the installation and set periods. The Engineer will determine the atmospheric conditions and pavement surface conditions that produce satisfactory results.

Using the application equipment, the pavement markings shall be applied in the following manner, as a simultaneous operation:

- (a) The surface shall be air-blasted to remove any dirt and residue.
- (b) The resin shall be mixed and heated according to manufacturer's recommendations and sprayed onto the pavement surface.

The edge of the center line or lane line shall be offset a minimum distance of 2 in. (50 mm) from a longitudinal crack or joint. Edge lines shall be approximately 2 in. (50 mm) from the edge of pavement. The finished center and lane lines shall be straight, with the lateral deviation of any 10 ft (3 m) line not to exceed 1 in. (25 mm).

Notification. The Contractor shall notify the Engineer 72 hours prior to the placement of the markings in order that he/she can be present during the operation. At the time of notification, the Contractor shall provide the Engineer the manufacturer and lot numbers of polyurea and reflective media that will be used.

Inspection. The polyurea pavement markings will be inspected following installation according to Article 780.10 of the Standard Specifications, except, no later than December 15, and inspected following a winter performance period that extends 180 days from December 15.

Method of Measurement. This work will be measured for payment as follows:

- (a) Contract Quantities. The requirements for the use of contract quantities shall be according to Article 202.07(a).
- (b) Measured Quantities. Lines will be measured for payment in place in feet (meters). Double yellow lines will be measured as two separate lines.

Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for POLYUREA PAVEMENT MARKING TYPE I – LINE of the line width specified or for POLYUREA PAVEMENT MARKING TYPE II – LINE of the line width specified.

REFLECTIVE SHEETING ON CHANNELIZING DEVICES (BDE)

Effective: April 1, 2007

Revised: November 1, 2008

Revise the seventh paragraph of Article 1106.02 of the Standard Specifications to read:

“At the time of manufacturing, the retroreflective prismatic sheeting used on channelizing devices shall meet or exceed the initial minimum coefficient of retroreflection as specified in the following table. Measurements shall be conducted according to ASTM E 810, without averaging. Sheeting used on cones, drums and flexible delineators shall be reboundable as tested according to ASTM D 4956. Prestriped sheeting for rigid substrates on barricades shall be white and orange. **The sheeting shall be uniform in color and devoid of streaks throughout the length of each roll. The color shall conform to the latest appropriate standard color tolerance chart issued by the U.S. Department of Transportation, Federal Highway Administration, and to the daytime and nighttime color requirements of ASTM D 4956.**

Initial Minimum Coefficient of Retroreflection candelas/foot candle/sq ft (candelas/lux/sq m) of material				
Observation Angle (deg.)	Entrance Angle (deg.)	White	Orange	Fluorescent Orange
0.2	-4	365	160	150
0.2	+30	175	80	70
0.5	-4	245	100	95
0.5	+30	100	50	40”

Revise the first sentence of the first paragraph of Article 1106.02(c) of the Standard Specifications to read:

“Barricades and vertical panels shall have alternating white and orange stripes sloping downward at 45 degrees toward the side on which traffic will pass.”

Revise the third sentence of the first paragraph of Article 1106.02(d) of the Standard Specifications to read:

“The bottom panels shall be 8 x 24 in. (200 x 600 mm) with alternating white and orange stripes sloping downward at 45 degrees toward the side on which traffic will pass.”

REINFORCEMENT BARS (BDE)

Effective: November 1, 2005

Revised: April 1, 2009

Revise Article 1006.10(a) of the Standard Specifications to read:

“(a) Reinforcement Bars. Reinforcement bars will be accepted according to the current Bureau of Materials and Physical Research Policy Memorandum, “Reinforcement Bar and/or Dowel Bar Plant Certification Procedure”. The Department will maintain an approved list of producers.

- (1) Reinforcement Bars (Non-Coated). Reinforcement bars shall be according to ASTM A 706 (A 706M), Grade 60 (420) for deformed bars and the following.
- a. For straight bars furnished in cut lengths and with a well-defined yield point, the yield point shall be determined as the elastic peak load, identified by a halt or arrest of the load indicator before plastic flow is sustained by the bar and dividing it by the nominal cross-sectional area of the bar.
 - b. Tensile strength shall be a minimum of 1.20 times the yield strength.
 - c. For bars straightened from coils or bars bent from fabrication, there shall be no upper limit on yield strength; and for bar designation Nos. 3 - 6 (10 - 19), the elongation after rupture shall be at least 9%.
 - d. Heat Numbers. Bundles or bars at the construction site shall be marked or tagged with heat identification numbers of the bar producer.
 - e. Guided Bend Test. Bars may be subject to a guided bend test across two pins which are free to rotate, where the bending force shall be centrally applied with a fixed or rotating pin of a certain diameter as specified in Table 3 of ASTM A 706 (A 706M). The dimensions and clearances of this guided bend test shall be according to ASTM E 190.
 - f. Spiral Reinforcement. Spiral reinforcement shall be deformed or plain bars conforming to the above requirements or cold-drawn steel wire conforming to AASHTO M 32.
- (2) Epoxy Coated Reinforcement Bars. Epoxy coated reinforcement bars shall be according to Article 1006.10(a)(1) and shall be epoxy coated according to AASHTO M 284 (M 284M) and the following.
- a. Certification. The epoxy coating applicator shall be certified according to the current Bureau of Materials and Physical Research Policy Memorandum, "Epoxy Coating Plant Certification Procedure". The Department will maintain an approved list.
 - b. Coating Thickness. When spiral reinforcement is coated after fabrication, the thickness of the epoxy coating shall be 7 to 20 mils (0.18 to 0.50 mm).
 - c. Cutting Reinforcement. Reinforcement bars may be sheared or sawn to length after coating, providing the end damage to the coating does not extend more than 0.5 in. (13 mm) back and the cut is patched before any visible rusting appears. Flame cutting will not be permitted."

REINFORCEMENT BARS - STORAGE AND PROTECTION (BDE)

Effective: August 1, 2008

Revised: April 1, 2009

Revise Article 508.03 of the Standard Specifications to read:

“508.03 Storage and Protection. Reinforcement bars shall be stored off the ground using platforms, skids, or other supports; and shall be protected from mechanical injury and from deterioration by exposure. Epoxy coated bars shall be stored on wooden or padded steel cribbing and all systems for handling shall have padded contact areas. The bars or bundles shall not be dragged or dropped.

When epoxy coated bars are stored in a manner where they will be exposed to the weather more than 60 days prior to use, they shall be protected from deterioration such as that caused by sunlight, salt spray, and weather exposure. The protection shall consist of covering with opaque polyethylene sheeting or other suitable opaque material. The covering shall be secured and allow for air circulation around the bars to minimize condensation under the cover.

Covering of the epoxy coated bars will not be required when the bars are installed and tied, or when they are partially incorporated into the concrete.”

RETROREFLECTIVE SHEETING, NONREFLECTIVE SHEETING, AND TRANSLUCENT OVERLAY FILM FOR HIGHWAY SIGNS (BDE)

Effective: April 1, 2007

General. This special provision covers retroreflective sheeting and translucent overlay films intended for application on new or refurbished aluminum. The sheeting serves as the reflectorized background for sign messages and as cutout legends and symbols applied to the reflectorized background. Messages may be applied in opaque black or transparent colors.

This special provision also covers nonreflective sheeting for application on new or refurbished aluminum, and as material for cutout legends and symbols applied to the reflectorized background.

All material furnished under this specification shall have been manufactured within 18 months of the delivery date. All material shall be supplied by the same manufacturer.

Retroreflective Sheeting Properties. Retroreflective sheeting shall consist of a flexible, colored, prismatic, or glass lens elements adhered to a synthetic resin, encapsulated by a flexible, transparent plastic having a smooth outer surface and shall meet the following requirements.

Only suppliers whose products have been tested and approved in the Department’s periodic Sheeting Study will be eligible to supply material. All individual batches and or lots of material shall be tested and approved by the Department. The Department reserves the right to sample and test delivered materials according to Federal Specification LS-300.

- (a) Adhesive. The sheeting shall have a Class 1, pre-coated, pressure sensitive adhesive according to ASTM D 4956. The adhesive shall have a protective liner that is easily removed when tested according to ASTM D 4956. The adhesive shall be capable of being applied to new or refurbished aluminum and reflectorized backgrounds without additional adhesive.
- (b) Color. The sheeting shall be uniform in color and devoid of streaks throughout the length of each roll. The color shall conform to the latest appropriate standard color tolerance

chart issued by the U.S. Department of Transportation, Federal Highway Administration and to the daytime and nighttime color requirements of ASTM D 4956. Sheeting used for side by side overlay applications shall have a Hunter Lab Delta E of less than 3.

- (c) Coefficient of Retroreflection. When tested according to ASTM E 810, without averaging, the sheeting shall have a minimum coefficient of retroreflection as shown in the following tables. The brightness of the sheeting when totally wet shall be a minimum of 90 percent of the values shown when tested according to the standard rainfall test specified in Section 7.10.1 of AASHTO M 268-84.

Type A Sheeting
 Minimum Coefficient of Retroreflection
 candelas/foot candle/sq ft (candelas/lux/sq m) of material

Type A

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Orange	Red	Green	Blue	Brown
0.2	-4	250	170	100	45	45	20	12
0.2	+30	150	100	60	25	25	12	8.5
0.5	-4	95	65	30	15	15	8	5
0.5	+30	75	50	25	10	10	5	3.5

Type AA Sheeting
 Minimum Coefficient of Retroreflection
 candelas/foot candle/sq ft (candelas/lux/sq m) of material

Type AA (0 and 90 degree rotation)

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Red	Green	Blue	FO
0.2	-4	800	660	215	80	43	200
0.2	+30	400	340	100	35	20	120
0.5	-4	200	160	45	20	9.8	80
0.5	+30	100	85	26	10	5.0	50

Type AA (45 degree rotation)

Observation Angle (deg.)	Entrance Angle (deg.)	Yellow	FO
0.2	-4	550	165
0.2	+30	130	45
0.5	-4	145	70
0.5	+30	70	40

Type AP Sheeting
 Minimum Coefficient of Retroreflection
 candelas/foot candle/sq ft (candelas/lux/sq m) of material

Type AP

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Red	Green	Blue	Brown	FO
0.2	-4	550	425	100	75	50	30	275
0.2	+30	200	150	40	35	25	15	90
0.5	-4	300	250	60	35	25	20	150
0.5	+30	100	70	20	20	10	5	50

Type AZ Sheeting
 Minimum Coefficient of Retroreflection
 candelas/foot candle/sq ft (candelas/lux/sq m) of material

Type AZ (0 degree rotation)

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Red	Green	Blue	FYG	FY
0.2	-4	430	350	110	45	20	325	240
0.2	+30	235	140	60	24	11	200	150
0.5	-4	250	200	60	25	10	235	165
0.5	+30	170	135	40	19	7	105	75
1.0	-4	70	45	10	10	4	70	30
1.0	+30	30	20	7	5	2.5	45	15

Type AZ (90 degree rotation)

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Red	Green	Blue	FYG	FY
0.2	-4	320	250	100	45	20	300	220
0.2	+30	235	140	40	24	11	200	150
0.5	-4	240	200	60	25	10	235	165
0.5	+30	100	85	20	10	7	80	75
1.0	-4	30	30	7	5	4	65	20
1.0	+30	15	15	5	2	2	30	10

(d) Gloss. The sheeting surface shall exhibit a minimum 85 degree gloss-meter rating of 50 when tested according to ASTM D 523.

(e) Durability. When processed and applied, the sheeting shall be weather resistant.

Accelerated weathering testing will be performed for 1000 hours (300 hours for orange/FO) according to ASTM G 151. The testing cycle will consist of 8 hours of light at 140 °F (60 °C), followed by 4 hours of condensation at 104 °F (40 °C). Following accelerated weathering, the sheeting shall exhibit a minimum of 80 percent of its initial minimum coefficient of retroreflection as listed in the previous tables.

Outdoor weathering will entail an annual evaluation of material placed in an outdoor rack with a 45 degree angle and a southern sun exposure. The sheeting will be evaluated for five years. Following weathering, the test specimens will be cleaned by immersing them in a five percent hydrochloric acid solution for 45 seconds, then rinsed with water and

blotted dry with a soft clean cloth. Following cleaning, the applied sheeting shall show no appreciable discoloration, cracking, streaking, crazing, blistering, or dimensional change. The sheeting shall exhibit a Hunter Lab Delta E of 5 or less when compared to the original.

- (f) Shrinkage. When tested according to ASTM D 4956, the sheeting shall not shrink in any dimension more than 1/32 in. (0.8 mm) in ten minutes and not more than 1/8 in. (3 mm) in 24 hours.
- (g) Workability. The sheeting shall show no cracking, scaling, pitting, blistering, edge lifting, inter-film splitting, curling, or discoloration when processed and applied using mutually acceptable processing and application procedures.
- (h) Splices. A single roll of sheeting shall contain a maximum of four splices per 50 yd (45 m) length. The sheeting shall be overlapped a minimum of 3/16 in. (5 mm) at each splice.
- (i) Adhesive Bond. The sheeting shall form a durable bond to smooth, corrosion and weather-resistant surfaces and adhere securely when tested according to ASTM D 4956.
- (j) Positionability. Sheeting, with ASTM D 4956 Class 3 adhesive, used for manufacturing cutout legends and borders shall provide sufficient positionability during the fabrication process to permit removal and reapplication without damage to either the legend or sign background and shall have a plastic liner suitable for use on bed cutting machines. Thereafter, all other adhesive and bond requirements contained in the specification shall apply.

Positionability shall be verified by cutting 4 in. (100 mm) letters E, I, K, M, S, W, and Y out of the positionable material. The letters shall then be applied to a sheeted aluminum blank using a single pass of a two pound roller. The letters shall sit for five minutes and then a putty knife shall be used to lift a corner. The thumb and fore finger shall be used to slowly pull the lifted corner to lift letters away from the sheeted aluminum. The letters shall not tear or distort when removed.

- (k) Thickness. The thickness of the sheeting without the protective liner shall be less than or equal to 0.015 in. (0.4 mm), or 0.025 in. (0.6 mm) for prismatic material.
- (l) Processing. The sheeting shall permit cutting and color processing according to the sheeting manufacturer's specifications at temperatures of 60 to 100 °F (15 to 38 °C) and within a relative humidity range of 20 to 80 percent. The sheeting shall be heat resistant and permit forced curing without staining the applied or unapplied sheeting at temperatures recommended by the manufacturer. The sheeting shall be solvent resistant and capable of being cleaned with VM&P naphtha, mineral spirits, and turpentine.

Transparent color and opaque black inks shall be single component and low odor. The inks shall dry within eight hours and not require clear coating. After color processing on white sheeting, the sheeting shall show no appreciable discoloration, cracking, streaking, crazing, blistering, or dimensional change when tested for durability (e). The ink on the weathered, prepared panel shall exhibit a Hunter Lab Delta E of 5 or less when compared to the original.

Transparent color electronic cutting films shall be acrylic. After application to white sheeting, the films shall show no appreciable discoloration, cracking, streaking, crazing, blistering, or dimensional change when tested for durability (e). The films on the weathered, prepared panel shall exhibit a Hunter Lab Delta E of 5 or less when compared to the original.

Transparent colors screened, or transparent acrylic electronic cutting films, on white sheeting, shall have a minimum initial coefficient of retroreflection values of 50 percent for yellow and red, and a minimum 70 percent for green, blue, and brown of the 0.2 degree observation angle/-4.0 degree entrance angle values as listed in the previous tables for the color being applied. After durability testing, the colors shall retain a minimum 80 percent of the initial coefficient of retroreflection.

- (m) Identification. The sheeting shall have a distinctive overall pattern in the sheeting unique to the manufacturer. If material orientation is required for optimum retroreflectivity, permanent orientation marks shall be incorporated into the face of the sheeting. Neither the overall pattern nor the orientation marks shall interfere with the reflectivity of the sheeting.
- (n) Packaging. Both ends of each box shall be clearly labeled with the sheeting type, color, adhesive type, manufacturer's lot number, date of manufacture, and supplier's name. Material Safety Data Sheets and technical bulletins for all materials shall be furnished to the Department with each shipment.

Nonreflective Sheeting Properties. Nonreflective sheeting shall consist of a flexible, pigmented cast vinyl film having a smooth, flat outer surface and shall meet the following requirements.

The Department reserves the right to sample and test delivered materials according to Federal Specification LS-300.

- (a) Adhesive. The sheeting shall have a Class 1, pre-coated, pressure sensitive adhesive according to ASTM D 4956. The adhesive shall have a protective liner that is easily removed when tested according to ASTM D 4956. The adhesive shall be capable of being applied to new or refurbished aluminum and reflectorized backgrounds without additional adhesive.
- (b) Color. The sheeting shall be uniform in color and devoid of streaks throughout the length of each roll.
- (c) Gloss. The sheeting shall exhibit a minimum 85 degree gloss-meter rating of 40 when tested according to ASTM D 523.
- (d) Durability. Applied sheeting that has been vertically exposed to the elements for seven years shall show no appreciable discoloration, cracking, crazing, blistering, delamination, or loss of adhesion. A slight amount of chalking is permitted but the sheeting shall not support fungus growth.

(e) Testing. Test panels shall be prepared by applying the sheeting to 6 1/2 x 6 1/2 in. (165 x 165 mm) pieces of aluminum according to the manufacturer's specifications. The edges of the panel shall be trimmed evenly and aged 48 hours at 70 to 90 °F (21 to 32 °C). Shrinkage and immersion testing shall be as follows.

(1) Shrinkage. The sheeting shall not shrink more than 1/64 in. (0.4 mm) from any panel edge when subjected to a temperature of 150 °F (66 °C) for 48 hours and shall be sufficiently heat resistant to retain adhesion after one week at 150 °F (66 °C).

(2) Immersion Testing. The sheeting shall show no appreciable decrease in adhesion, color, or general appearance when examined one hour after being immersed to a depth of 2 or 3 in. (50 or 75 mm) in the following solutions at 70 to 90 °F (21 to 32 °C) for specified times.

Solution	Immersion Time (hours)
Reference Fuel (M I L-F-8799A) (15 parts xylol and 85 parts mineral spirits by weight)	1
Distilled Water	24
SAE No. 20 Motor Oil	24
Antifreeze (1/2 ethylene glycol, 1/2 distilled water)	24

(f) Adhesive Bond: The sheeting shall form a durable bond to smooth, corrosion and weather-resistant surfaces and adhere securely when tested according to ASTM D 4956.

(g) Thickness. The thickness of the sheeting without the protective liner shall be a maximum of 0.005 in. (0.13 mm).

(h) Cutting. Material used on bed cutting machines shall have a smooth plastic liner.

(i) Identification. The sheeting shall have a distinctive overall pattern in the sheeting unique to the manufacturer. If material orientation is required for optimum retroreflectivity, permanent orientation marks shall be incorporated into the face of the sheeting. Neither the overall pattern nor the orientation marks shall interfere with the reflectivity of the sheeting.

(j) Packaging. Both ends of each box shall be clearly labeled with the sheeting type, color, adhesive type, manufacturer's lot number, date of manufacture, and supplier's name. Material Safety Data Sheets and technical bulletins for all materials shall be furnished to the Department with each shipment.

SEEDING (BDE)

Effective: July 1, 2004

Revised: July 1, 2009

Revise the following seeding mixtures shown in Table 1 of Article 250.07 of the Standard Specifications to read:

"Table 1 - SEEDING MIXTURES		
Class – Type	Seeds	lb/acre (kg/hectare)
1A Salt Tolerant Lawn Mixture 7/	Bluegrass Perennial Ryegrass Red Fescue (Audubon, Sea Link, or Epic) Hard Fescue (Rescue 911, Spartan II, or Reliant IV) Fults Salt Grass 1/ or Salty Alkaligrass	60 (70) 20 (20) 20 (20) 20 (20) 60 (70)
2 Roadside Mixture 7/	Tall Fescue (Inferno, Tarheel II, Quest, Blade Runner, or Falcon IV) Perennial Ryegrass Creeping Red Fescue Red Top	100 (110) 50 (55) 40 (50) 10 (10)
2A Salt Tolerant Roadside Mixture 7/	Tall Fescue (Inferno, Tarheel II, Quest, Blade Runner, or Falcon IV) Perennial Ryegrass Red Fescue (Audubon, Sea Link, or Epic) Hard Fescue (Rescue 911, Spartan II, or Reliant IV) Fults Salt Grass 1/ or Salty Alkaligrass	60 (70) 20 (20) 30 (20) 30 (20) 60 (70)
3 Northern Illinois Slope Mixture 7/	Elymus Canadensis (Canada Wild Rye) Perennial Ryegrass Alsike Cover 2/ Desmanthus Illinoensis (Illinois Bundleflower) 2/, 5/ Andropogon Scoparius (Little Bluestem) 5/ Bouteloua Curtipendula (Side-Oats Grama) Fults Salt Grass 1/ or Salty Alkaligrass Oats, Spring Slender Wheat Grass 5/ Buffalo Grass (Cody or Bowie) 4/, 5/, 9/	5 (5) 20 (20) 5 (5) 2 (2) 12 (12) 10 (10) 30 (35) 50 (55) 15 (15) 5 (5)
6A Salt Tolerant Conservation Mixture	Andropogon Scoparius (Little Bluestem) 5/ Elymus Canadensis (Canada Wild Rye) 5/ Buffalo Grass (Cody or Bowie) 4/, 5/, 9/ Vernal Alfalfa 2/ Oats, Spring Fults Salt Grass 1/ or Salty Alkaligrass	5 (5) 2 (2) 5 (5) 15 (15) 48 (55) 20 (20)"

Revise Note 7 of Table 1 – Seeding Mixtures of Article 250.07 of the Standard Specifications to read:

“7/ In Districts 1 through 6, the planting times shall be April 1 to June 15 and August 1 to November 1. In Districts 7 through 9, the planting times shall be March 1 to June 1 and August 1 to November 15. Seeding may be performed outside these dates provided the Contractor guarantees a minimum of 75 percent uniform growth over the entire seeded area(s) after a period of establishment. Inspection dates for the period of establishment will be as follows: Seeding conducted in Districts 1 through 6 between June 16 and July 31 will be inspected after April 15 and seeding conducted between November 2 and March 31 will be inspected after September 15. Seeding conducted in Districts 7 through 9 between June 2 and July 31 will be inspected after April 15 and seeding conducted between November 16 and February 28 will be inspected after September 15. The guarantee shall be submitted to the Engineer in writing prior to performing the work. After the period of establishment, areas not exhibiting 75 percent uniform growth shall be interseeded or reseeded, as determined by the Engineer, at no additional cost to the Department.”

Delete the last sentence of the first paragraph of Article 1081.04(c)(2) of the Standard Specifications.

Revise Table II of Article 1081.04(c)(6) of the Standard Specifications to read:

TABLE II						
Variety of Seeds	Hard Seed	Purity	Pure Live	Weed	Secondary *	Notes
	%	%	Seed %	%	Noxious Weeds	
	Max.	Min.	Min.	Max.	No. per oz (kg) Max. Permitted	
Alfalfa	20	92	89	0.50	6 (211)	1/
Clover, Alsike	15	92	87	0.30	6 (211)	2/
Red Fescue, Audubon	0	97	82	0.10	3 (105)	-
Red Fescue, Creeping	-	97	82	1.00	6 (211)	-
Red Fescue, Epic	-	98	83	0.05	1 (35)	-
Red Fescue, Sea Link	-	98	83	0.10	3 (105)	-
Tall Fescue, Blade Runner	-	98	83	0.10	2 (70)	-
Tall Fescue, Falcon IV	-	98	83	0.05	1 (35)	-
Tall Fescue, Inferno	0	98	83	0.10	2 (70)	-
Tall Fescue, Tarheel II	-	97	82	1.00	6 (211)	-
Tall Fescue, Quest	0	98	83	0.10	2 (70)	-
Fults Salt Grass	0	98	85	0.10	2 (70)	-
Salty Alkaligrass	0	98	85	0.10	2 (70)	-
Kentucky Bluegrass	-	97	80	0.30	7 (247)	4/
Oats	-	92	88	0.50	2 (70)	3/
Redtop	-	90	78	1.80	5 (175)	3/
Ryegrass, Perennial, Annual	-	97	85	0.30	5 (175)	3/
Rye, Grain, Winter	-	92	83	0.50	2 (70)	3/
Hard Fescue, Reliant IV	-	98	83	0.05	1 (35)	-
Hard Fescue, Rescue 911	0	97	82	0.10	3 (105)	-
Hard Fescue, Spartan II	-	98	83	0.10	3 (105)	-
Timothy	-	92	84	0.50	5 (175)	3/
Wheat, hard Red Winter	-	92	89	0.50	2 (70)	3/”

Revise the first sentence of the first paragraph of Article 1081.04(c)(7) of the Standard Specifications to read:

“The seed quantities indicated per acre (hectare) for Prairie Grass Seed in Classes 3, 3A, 4, 4A, 6, and 6A in Article 250.07 shall be the amounts of pure, live seed per acre (hectare) for each species listed.”

SELF-CONSOLIDATING CONCRETE FOR PRECAST PRODUCTS (BDE)

Effective: July 1, 2004

Revised: January 1, 2007

Definition. Self-consolidating concrete is a flowable mixture that does not require mechanical vibration for consolidation.

Usage. Self-consolidating concrete may be used for precast concrete products.

Materials. Materials shall be according to Section 1021 of the Standard Specifications.

Mix Design Criteria. The mix design criteria shall be as follows:

- (a) The minimum cement factor shall be according to Article 1020.04 of the Standard Specifications. If the maximum cement factor is not specified, it shall not exceed 7.05 cwt/cu yd (418 kg/cu m).
- (b) The maximum allowable water/cement ratio shall be according to Article 1020.04 of the Standard Specifications or 0.44, whichever is lower.
- (c) The slump requirements of Article 1020.04 of the Standard Specifications shall not apply.
- (d) The coarse aggregate gradations shall be CA 13, CA 14, CA 16, or a blend of these gradations. CA 11 may be used when the Contractor provides satisfactory evidence to the Engineer that the mix will not segregate. The fine aggregate proportion shall be a maximum 50 percent by weight (mass) of the total aggregate used.
- (e) The slump flow range shall be ± 2 in. (± 50 mm) of the Contractor target value, and within the overall Department range of 20 in. (510 mm) minimum to 28 in. (710 mm) maximum.
- (f) The visual stability index shall be a maximum of 1.
- (g) The J-ring value shall be a maximum of 4 in. (100 mm). The Contractor may specify a lower maximum in the mix design.
- (h) The L-box blocking ratio shall be a minimum of 60 percent. The Contractor may specify a higher minimum in the mix design.
- (i) The column segregation index shall be a maximum 15 percent.

(j) The hardened visual stability index shall be a maximum of 1.

Placing and Consolidating. The maximum distance of horizontal flow from the point of deposit shall be 25 ft (7.6 m), unless approved otherwise by the Engineer.

Concrete shall be rodded with a piece of lumber, conduit, or vibrator if the material has lost its fluidity prior to placement of additional concrete. The vibrator shall be the pencil head type with a maximum diameter or width of 1 in. (25 mm). Any other method for restoring the fluidity of the concrete shall be approved by the Engineer.

Mix Design Approval. The Contractor shall obtain mix design approval according to the Department's Policy Memorandum "Quality Control/Quality Assurance Program for Precast Concrete Products".

SIGN PANELS AND SIGN PANEL OVERLAYS (BDE)

Effective: November 1, 2008

Description. This work shall consist of furnishing, fabricating, and installing sign panels and/or sign panel overlays. Work shall be according to Sections 720 and 721 of the Standard Specifications, except as modified herein.

Materials. Type AP and AZ sheeting shall meet the requirements of the special provision, "Retroreflective Sheeting, Nonreflective Sheeting, and Translucent Overlay Film for Highway Signs". Type ZZ sheeting shall meet the requirements of the special provision, "Type ZZ Retroreflective Sheeting, Nonreflective Sheeting, and Translucent Overlay Film for Highway Signs".

The sheeting for the background, legend, border, shields, and symbols shall be provided by the same manufacturer.

CONSTRUCTION REQUIREMENTS

Fabrication. Signs shall be fabricated according to the current Bureau of Operations Policy Memorandum, "Fabrication of Highway Signs", the MUTCD, the FHWA Standard Highway Signs manual, the Illinois standard highway signs, and as shown on the plans.

Signs shall be fabricated such that the material for the background, legend, border, shields, and symbols is applied in the preferred orientation for the maximum retroreflectivity per the manufacturer's recommendation. The nesting of legend, border, shields, or symbols will not be permitted.

SILT FILTER FENCE (BDE)

Effective: January 1, 2008

For silt filter fence fabric only, revise Article 1080.02 of the Standard Specifications to read:

“1080.02 Geotextile Fabric. The fabric for silt filter fence shall be a woven fabric meeting the requirements of AASHTO M 288 for unsupported silt fence with less than 50 percent geotextile elongation.”

Replace the last sentence of Article 1081.15(b) of the Standard Specifications with the following:

“Silt filter fence stakes shall be a minimum of 4 ft (1.2 m) long and made of either wood or metal. Wood stakes shall be 2 in. x 2 in. (50 mm x 50 mm). Metal stakes shall be a standard T or U shape having a minimum weight (mass) of 1.32 lb/ft (600 g/300 mm).”

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: April 2, 2005

To account for the preparatory work and operations necessary for the movement of subcontractor personnel, equipment, supplies, and incidentals to the project site and for all other work or operations that must be performed or costs incurred when beginning work approved for subcontracting in accordance with Article 108.01 of the Standard Specifications, the Contractor shall make a mobilization payment to each subcontractor.

This mobilization payment shall be made at least 14 days prior to the subcontractor starting work. The amount paid shall be equal to 3 percent of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor’s work.

This provision shall be incorporated directly or by reference into each subcontract approved by the Department.

TEMPORARY EROSION CONTROL (BDE)

Effective: November 1, 2002

Revised: January 1, 2008

Revise the third paragraph of Article 280.03 of the Standard Specifications to read:

“Erosion control systems shall be installed prior to beginning any activities which will potentially create erodible conditions. Erosion control systems for areas outside the limits of construction such as storage sites, plant sites, waste sites, haul roads, and Contractor furnished borrow sites shall be installed prior to beginning soil disturbing activities at each area. These offsite systems shall be designed by the Contractor and be subject to the approval of the Engineer.”

Add the following paragraph after the third paragraph of Article 280.03 of the Standard Specifications:

“The temporary erosion and sediment control systems shown on the plans represent the minimum systems anticipated for the project. Conditions created by the Contractor’s operations, or for the Contractor’s convenience, which are not covered by the plans, shall be protected as directed by the Engineer at no additional cost to the Department. Revisions or modifications of the erosion and sediment control systems shall have the Engineer’s written approval.”

Add the following paragraph after the ninth paragraph of Article 280.07 of the Standard Specifications:

“Temporary or permanent erosion control systems required for areas outside the limits of construction will not be measured for payment.”

Delete the tenth (last) paragraph of Article 280.08 of the Standard Specifications.

THERMOPLASTIC PAVEMENT MARKINGS (BDE)

Effective: January 1, 2007

Revise Article 1095.01(a)(2) of the Standard Specifications to read:

“(2) Pigment. The pigment used for the white thermoplastic compound shall be a high-grade pure (minimum 93 percent) titanium dioxide (TiO₂). The white pigment content shall be a minimum of ten percent by weight and shall be uniformly distributed throughout the thermoplastic compound.

The pigments used for the yellow thermoplastic compound shall not contain any hazardous materials listed in the Environmental Protection Agency Code of Federal Regulations (CFR) 40, Section 261.24, Table 1. The combined total of RCRA listed heavy metals shall not exceed 100 ppm when tested by X-ray fluorescence spectroscopy. The pigments shall also be heat resistant, UV stable and color-fast yellows, golds, and oranges, which shall produce a compound which shall match Federal Standard 595 Color No. 33538. The pigment shall be uniformly distributed throughout the thermoplastic compound.”

Revise Article 1095.01(b)(1)e. of the Standard Specifications to read:

“e. Daylight Reflectance and Color. The thermoplastic compound after heating for four hours ± five minutes at 425 ± 3 °F (218.3 ± 2 °C) and cooled at 77 °F (25 °C) shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45 degree circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White: Daylight Reflectance75 percent min.

*Yellow: Daylight Reflectance45 percent min.

*Shall meet the coordinates of the following color tolerance chart.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456”

Revise Article 1095.01(b)(1)k. of the Standard Specifications to read:

- “k. Accelerated Weathering. After heating the thermoplastic for four hours \pm five minutes at 425 ± 3 °F (218.3 ± 2 °C) the thermoplastic shall be applied to a steel wool abraded aluminum alloy panel (Federal Test Std. No. 141, Method 2013) at a film thickness of 30 mils (0.70 mm) and allowed to cool for 24 hours at room temperature. The coated panel shall be subjected to accelerated weathering using the light and water exposure apparatus (fluorescent UV - condensation type) for 75 hours according to ASTM G 53 (equipped with UVB-313 lamps).

The cycle shall consist of four hours UV exposure at 122 °F (50 °C) followed by four hours of condensation at 104 °F (40 °C). UVB 313 bulbs shall be used. At the end of the exposure period, the panel shall not exceed 10 Hunter Lab Delta E units from the original material.”

TRAINING SPECIAL PROVISIONS

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 3. 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 will 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.

TYPE ZZ RETROREFLECTIVE SHEETING, NONREFLECTIVE SHEETING, AND TRANSLUCENT OVERLAY FILM FOR HIGHWAY SIGNS (BDE)

Effective: April 1, 2007

General. This special provision covers Type ZZ retroreflective sheeting and translucent overlay films intended for application on new or refurbished aluminum. The sheeting serves as the reflectorized background for sign messages and as cutout legends and symbols applied to the reflectorized background. Messages may be applied in opaque black or transparent colors.

This special provision also covers nonreflective sheeting for application on new or refurbished aluminum, and as material for cutout legends and symbols applied to the reflectorized background.

All material furnished under this specification shall have been manufactured within 18 months of the delivery date. All material shall be supplied by the same manufacturer.

Type ZZ Retroreflective Sheeting Properties. Type ZZ retroreflective sheeting shall consist of a flexible, colored, cubed corner prismatic, retroreflective material encapsulated by a flexible, transparent plastic having a smooth outer surface and shall meet the following requirements.

Only suppliers whose products have been tested and approved in the Department's periodic Sheeting Study will be eligible to supply material. All individual batches and or lots of material shall be tested and approved by the Department. The Department reserves the right to sample and test delivered materials according to Federal Specification LS-300.

- (a) Adhesive. The sheeting shall have a Class 1, pre-coated, pressure sensitive adhesive according to ASTM D 4956. The adhesive shall have a protective liner that is easily removed when tested according to ASTM D 4956. The adhesive shall be capable of being applied to new or refurbished aluminum without additional adhesive.
- (b) Color. The sheeting shall be uniform in color and devoid of streaks throughout the length of each roll. The color shall conform to the latest appropriate standard color tolerance chart issued by the U.S. Department of Transportation, Federal Highway Administration and to the daytime and nighttime color requirements of ASTM D 4956. Sheeting used for side by side overlay applications shall have a Hunter Lab Delta E of less than 3.
- (c) Coefficient of Retroreflection. When tested according to ASTM E 810, the sheeting shall have a minimum coefficient of retroreflection as shown in the following tables. The brightness of the sheeting when totally wet shall be a minimum of 90 percent of the values shown when tested according to the standard rainfall test specified in Section 7.10.1 of AASHTO M 268-84.

Type ZZ Sheeting
 Minimum Coefficient of Retroreflection
 candelas/foot candle/sq ft (candelas/lux/sq m) of material

Type ZZ (0 degree rotation)

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Red	Green	Blue	FYG	FY	FO
0.2	-4	725	545	145	75	35	580	435	255
0.2	+30	300	225	60	30	15	240	180	105
0.5	-4	450	340	90	45	20	360	270	160
0.5	+30	180	135	40	20	10	145	110	65
1.0	-4	130	100	30	15	6	105	80	50
1.0	+30	70	55	15	10	3	60	45	25

Type ZZ (90 degree rotation)

Observation Angle (deg.)	Entrance Angle (deg.)	White	Yellow	Red	Green	Blue	FYG	FY	FO
0.2	-4	415	305	85	42	17	340	145	85
0.2	+30	80	60	18	14	4.4	64	48	23
0.5	-4	350	260	70	35	16	280	210	80
0.5	+30	75	56	15	12	3.6	60	45	25
1.0	-4	110	80	18	11	4.8	87	64	22
1.0	+30	20	13	3	2	1	12	9	3

(d) Gloss. The sheeting surface shall exhibit a minimum 85 degree gloss-meter rating of 50 when tested according to ASTM D 523.

(e) Durability. When processed and applied, the sheeting shall be weather resistant.

Accelerated weathering testing will be performed for 1000 hours (300 hours for orange/FO) according to ASTM G 151. The testing cycle will consist of 8 hours of light at 140 °F (60 °C), followed by 4 hours of condensation at 104 °F (40 °C). Following accelerated weathering, the sheeting shall exhibit a minimum of 80 percent of its initial minimum coefficient of retroreflection as listed in the previous tables.

Outdoor weathering will entail an annual evaluation of material placed in an outdoor rack with a 45 degree angle and a southern sun exposure. The sheeting will be evaluated for five years. Following weathering, the test specimens will be cleaned by immersing them in a five percent hydrochloric acid solution for 45 seconds, then rinsed with water and blotted dry with a soft clean cloth. Following cleaning, the applied sheeting shall show no appreciable discoloration, cracking, streaking, crazing, blistering, or dimensional change. The sheeting shall exhibit a Hunter Lab Delta E of 5 or less when compared to the original.

(f) Shrinkage. When tested according to ASTM D 4956, the sheeting shall not shrink in any dimension more than 1/32 in. (0.8 mm) in ten minutes and not more than 1/8 in. (3 mm) in 24 hours.

(g) Workability. The sheeting shall show no cracking, scaling, pitting, blistering, edge lifting, inter-film splitting, curling, or discoloration when processed and applied using mutually acceptable processing and application procedures.

(h) Splices. A single roll of sheeting shall contain a maximum of four splices per 50 yd (45 m) length. The sheeting shall be overlapped a minimum of 3/16 in. (5 mm) at each splice.

(i) Adhesive Bond. The sheeting shall form a durable bond to smooth, corrosion and weather-resistant surfaces and adhere securely when tested according to ASTM D 4956.

(j) Positionability. Sheeting, with ASTM D 4956 Class 3 adhesive, used for manufacturing cutout legends and borders shall provide sufficient positionability during the fabrication process to permit removal and reapplication without damage to either the legend or sign background and shall have a plastic liner suitable for use on bed cutting machines. Thereafter, all other adhesive and bond requirements contained in the specification shall apply.

Positionability shall be verified by cutting 4 in. (100 mm) letters E, I, K, M, S, W, and Y out of the positionable material. The letters shall then be applied to a sheeted aluminum blank using a single pass of a two pound roller. The letters shall sit for five minutes and then a putty knife shall be used to lift a corner. The thumb and fore finger shall be used to slowly pull the lifted corner to lift letters away from the sheeted aluminum. The letters shall not tear or distort when removed.

- (k) Thickness. The thickness of the sheeting without the protective liner shall be less than or equal to 0.025 in. (0.6 mm).
- (l) Processing. The sheeting shall permit cutting and color processing according to the sheeting manufacturer's specifications at temperatures of 60 to 100 °F (15 to 38 °C) and within a relative humidity range of 20 to 80 percent. The sheeting shall be heat resistant and permit forced curing without staining the applied or unapplied sheeting at temperatures recommended by the manufacturer. The sheeting shall be solvent resistant and capable of being cleaned with VM&P naphtha, mineral spirits, and turpentine.

Transparent color and opaque black inks shall be single component and low odor. The inks shall dry within eight hours and not require clear coating. After color processing on white sheeting, the sheeting shall show no appreciable discoloration, cracking, streaking, crazing, blistering, or dimensional change when tested for durability (e). The ink on the weathered, prepared panel shall exhibit a Hunter Lab Delta E of 5 or less when compared to the original.

Transparent color electronic cutting films shall be acrylic. After application to white sheeting, the films shall show no appreciable discoloration, cracking, streaking, crazing, blistering, or dimensional change when tested for durability (e). The films on the weathered, prepared panel shall exhibit a Hunter Lab Delta E of 5 or less when compared to the original.

Transparent colors screened, or transparent acrylic electronic cutting films, on white sheeting, shall have a minimum initial coefficient of retroreflection values of 50 percent for yellow and red, and a minimum 70 percent for green, blue, and brown of the 0.2 degree observation angle/-4.0 degree entrance angle values as listed in the previous tables for the color being applied. After durability testing, the colors shall retain a minimum 80 percent of the initial coefficient of retroreflection.

- (m) Identification. The sheeting shall have a distinctive overall pattern in the sheeting unique to the manufacturer. If material orientation is required for optimum retroreflectivity, permanent orientation marks shall be incorporated into the face of the sheeting. Neither the overall pattern nor the orientation marks shall interfere with the reflectivity of the sheeting.
- (n) Packaging. Both ends of each box shall be clearly labeled with the sheeting type, color, adhesive type, manufacturer's lot number, date of manufacture, and supplier's name. Material Safety Data Sheets and technical bulletins for all materials shall be furnished to the Department with each shipment.

Nonreflective Sheeting Properties. Nonreflective sheeting shall consist of a flexible, pigmented cast vinyl film having a smooth, flat outer surface and shall meet the following requirements.

The Department reserves the right to sample and test delivered materials according to Federal Specification LS-300.

- (a) Adhesive. The sheeting shall have a Class 1, pre-coated, pressure sensitive adhesive according to ASTM D 4956. The adhesive shall have a protective liner that is easily

removed when tested according to ASTM D 4956. The adhesive shall be capable of being applied to new or refurbished aluminum and reflectorized backgrounds without additional adhesive.

- (b) Color. The sheeting shall be uniform in color and devoid of streaks throughout the length of each roll.
- (c) Gloss. The sheeting shall exhibit a minimum 85 degree gloss-meter rating of 40 when tested according to ASTM D 523.
- (d) Durability. Applied sheeting that has been vertically exposed to the elements for seven years shall show no appreciable discoloration, cracking, crazing, blistering, delamination, or loss of adhesion. A slight amount of chalking is permitted but the sheeting shall not support fungus growth.
- (e) Testing. Test panels shall be prepared by applying the sheeting to 6 1/2 x 6 1/2 in. (165 x 165 mm) pieces of aluminum according to the manufacturer's specifications. The edges of the panel shall be trimmed evenly and aged 48 hours at 70 to 90 °F (21 to 32 °C). Shrinkage and immersion testing shall be as follows.
 - (1) Shrinkage. The sheeting shall not shrink more than 1/64 in. (0.4 mm) from any panel edge when subjected to a temperature of 150 °F (66 °C) for 48 hours and shall be sufficiently heat resistant to retain adhesion after one week at 150 °F (66 °C).
 - (2) Immersion Testing. The sheeting shall show no appreciable decrease in adhesion, color, or general appearance when examined one hour after being immersed to a depth of 2 or 3 in. (50 or 75 mm) in the following solutions at 70 to 90 °F (21 to 32 °C) for specified times.

Solution	Immersion Time (hours)
Reference Fuel (M I L-F-8799A) (15 parts xylol and 85 parts mineral spirits by weight)	1
Distilled Water	24
SAE No. 20 Motor Oil	24
Antifreeze (1/2 ethylene glycol, 1/2 distilled water)	24

- (f) Adhesive Bond. The sheeting shall form a durable bond to smooth, corrosion and weather-resistant surfaces and adhere securely when tested according to ASTM D 4956.
- (g) Thickness. The thickness of the sheeting without the protective liner shall be a maximum of 0.005 in. (0.13 mm).
- (h) Cutting. Material used on bed cutting machines shall have a smooth plastic liner.

- (i) Identification. The sheeting shall have a distinctive overall pattern in the sheeting unique to the manufacturer. If material orientation is required for optimum retroreflectivity, permanent orientation marks shall be incorporated into the face of the sheeting. Neither the overall pattern nor the orientation marks shall interfere with the reflectivity of the sheeting.
- (j) Packaging. Both ends of each box shall be clearly labeled with the sheeting type, color, adhesive type, manufacturer's lot number, date of manufacture, and supplier's name. Material Safety Data Sheets and technical bulletins for all materials shall be furnished to the Department with each shipment.

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 X 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)	23 lb/ft (34 kg/m)
Furnishing Metal Pile Shells 12 in. (305 mm), 0.250 in. (6.35 mm) wall thickness)	32 lb/ft (48 kg/m)
Furnishing Metal Pile Shells 14 in. (356 mm), 0.250 in. (6.35 mm) wall thickness)	37 lb/ft (55 kg/m)
Other piling	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	20 lb/ft (30 kg/m)
Steel Plate Beam Guardrail, Type B w/steel posts	30 lb/ft (45 kg/m)
Steel Plate Beam Guardrail, Types A and B w/wood posts	8 lb/ft (12 kg/m)
Steel Plate Beam Guardrail, Type 2	305 lb (140 kg) each
Steel Plate Beam Guardrail, Type 6	1260 lb (570 kg) each
Traffic Barrier Terminal, Type 1 Special (Tangent)	730 lb (330 kg) each
Traffic Barrier Terminal, Type 1 Special (Flared)	410 lb (185 kg) each
Steel Traffic Signal and Light Poles, Towers and Mast Arms	
Traffic Signal Post	11 lb/ft (16 kg/m)
Light Pole, Tenon Mount and Twin Mount, 30 - 40 ft (9 - 12 m)	14 lb/ft (21 kg/m)
Light Pole, Tenon Mount and Twin Mount, 45 - 55 ft (13.5 - 16.5 m)	21 lb/ft (31 kg/m)
Light Pole w/Mast Arm, 30 - 50 ft (9 - 15.2 m)	13 lb/ft (19 kg/m)
Light Pole w/Mast Arm, 55 - 60 ft (16.5 - 18 m)	19 lb/ft (28 kg/m)
Light Tower w/Luminaire Mount, 80 - 110 ft (24 - 33.5 m)	31 lb/ft (46 kg/m)
Light Tower w/Luminaire Mount, 120 - 140 ft (36.5 - 42.5 m)	65 lb/ft (97 kg/m)
Light Tower w/Luminaire Mount, 150 - 160 ft (45.5 - 48.5 m)	80 lb/ft (119 kg/m)
Metal Railings (excluding wire fence)	
Steel Railing, Type SM	64 lb/ft (95 kg/m)
Steel Railing, Type S-1	39 lb/ft (58 kg/m)
Steel Railing, Type T-1	53 lb/ft (79 kg/m)
Steel Bridge Rail	52 lb/ft (77 kg/m)
Frames and Grates	
Frame	250 lb (115 kg)
Lids and Grates	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
- Structural Steel Yes
- Reinforcing Steel Yes
- Dowel Bars, Tie Bars and Mesh Reinforcement Yes
- Guardrail Yes
- Steel Traffic Signal and Light Poles, Towers and Mast Arms Yes
- Metal Railings (excluding wire fence) Yes
- Frames and Grates Yes

Signature: _____ **Date:** _____

CLOSED CIRCUIT DOME VIDEO CAMERA

1. DESCRIPTION.

This item shall consist of furnishing and installing an integrated Closed-Circuit Television (CCTV) Dome Camera Assembly as described herein and as indicated in the Plans.

2. DEFINITIONS:

CCTV Dome Camera The complete camera assembly including the camera, PTZ mechanism, upper and lower dome housings, and any mounts.

Dome, lower dome, dome bubble Clear dome (bubble) on the lower portion of the CCTV dome camera which the camera views through

Dome housing, upper dome The upper portion of the CCTV dome cameras which houses the camera and PTZ Mechanism.

PTZ The motorized Pan, Tilt and Zoom mechanism

Camera The color camera

3. MATERIALS.

3.1 General. The CCTV Dome Color Camera shall be a rugged, non-pressurized, outdoor surveillance domed camera system. The CCTV Dome Camera shall be designed to perform over a wide range of environmental and lighting conditions and automatically switches from color daytime to monochrome nighttime operation. For compatibility with the existing CCTV cameras installed on this expressway, the dome cameras shall be manufactured by Phillips/Bosch or equal approved by the Engineer. The equivalent shall comply with all the requirements herein and shall provide the same operation/functionality as the installed cameras without the use of any external devices for the modification/translation of video and PTZ commands.

All equipment and materials used shall be standard components that are regularly manufactured and utilized in the manufacturer's system.

The manufacturer shall be ISO 14001 Certified. The manufacturer's quality system shall be in compliance with the I.S./ISO 9001/EN 29001, QUALITY SYSTEM. The manufacturer shall provide a three year (3) warranty. The manufacturer shall pay inbound and outbound shipping charges during the warranty period for products returned as warranty claims. The manufacturer shall also provide an advance exchange program for warranty claims.

The warranty period shall begin on the date of final acceptance of the video distribution system. This warranty shall include repair or replacement of all failed components via a factory authorized repair facility. All items sent to the repair facility for repair shall be returned within two weeks of the date of receipt at the facility. The repair facility location shall be in the United States. Any extended warranty coverage required to comply with the specified warranty period shall be provided as a part of this pay item at no additional cost to the State.

- 3.2 Physical construction. The CCTV Dome Camera shall be provided in a NEMA 4X or IP66 certified, rugged, weather-resistant package. The CCTV Dome Camera shall also comply with the following requirements:

Environmental	Requirement
IP Rating	IP 66
Weight (max.)	10 lbs
Overall Dimensions	10" dia. x 14"
Humidity	0 to 100%
Operating temperature	-40°C to 50°C
Mount	1 ½" NPT

The CCTV dome camera shall be equipped with a fan and heater controlled by a thermostat. The heater shall prevent internal fogging of the lower dome throughout the operating temperature range of the camera.

An optional rugged clear dome bubble shall be available from the CCTV camera manufacturer. The rugged dome shall be made from 3mm thick polycarbonate, designed to meet stringent strength standards without compromising optical clarity. The dome, by itself, shall withstand a 100 foot-pound impact. This energy is equivalent to that of a 10 lb sledgehammer being dropped from a height of 10 feet. The dome, when installed in the CCTV camera, shall exceed the UL 1598 horizontal impact standard for lighting fixtures, by a factor of 10. The submittal needs to indicate compliance with this requirement.

- 3.3 Power. The CCTV Dome Camera shall be designed to operate from a 120v power source. The appropriate power supply, if required for the CCTV Dome Camera to operate, shall be included as a part of this item. The power requirements for the camera shall comply with the following:

Electrical	Requirement
Voltage	18 to 30 VAC
Load	25 VA
Heater Load	45 VA
Listing	UL Listed
FCC	Class B

Surge Suppression Requirements

Source	Minimum Requirements
Video	Peak current 10 kA (Gas Tube Arrester), peak power 1000 W (10/1000 μ)
RS-232/485, Biphase	Peak current 10 A, peak power 300 W (8/20 μ)
Alarm Inputs	Peak current 17 A, peak power 300 W (8/20 μ)
Alarm Outputs	Peak current 2 A, peak power 300 W (8/20 μ)
Relay Outputs	Peak current 7.3 A, peak power 600 W (10/1000 μ)
Power Input (Dome)	Peak current 7.3 A, peak power 600 W (10/1000 μ)
Power Output (Alarm Power Supply)	Peak current 21.4 A, peak power 1500 W(10/1000 μ)

3.4 Camera.

The CCTV Dome Camera shall incorporate a solid state CDD imaging camera with the following requirements.

- 3.4.1 The camera shall automatically switch from daylight color operation to a higher sensitivity nighttime monochrome mode when light levels fall below a user adjustable threshold level.
- 3.4.2 The camera shall provide a selectable slow shutter (frame integration) function that increases the camera's sensitivity up to 50 times by reducing the shutter speed. Selectable slow shutter speeds shall be 1/60 sec., 1/30 sec., 1/15 sec., 1/8 sec., 1/4 sec., 1/2 sec., 1 sec., and fully automatic.
- 3.4.3 Digital image stabilization shall be provided using electronic compensation that filters out vibrations caused by wind and other environmental conditions.

The camera shall also comply with the following requirements:

Camera	Requirement
Imager	1/4" HAD CCD
Effective Pixels	768H x 494V
Zoom Lens Power (Optical only)	36x
Aperture	f1.6 to f4.5
Focus	Auto / Manual
Iris	Auto / Manual
Maximum Field of View Horizontal	45°
Video Output	1.0v +/- 0.07v
Gain Control	Auto / off
Synchronization	Internal / AC line lock, phase adj. via remote control, V-Sync
Digital Zoom	12x
Horizontal Resolution	540 TVL
Signal – Noise Ratio	>50dB
White Balance	Auto / Manual
Shutter Speed	1/2 to 1/30,000

Min Illumination		Values in lux
Color	Fast Shut	2.00
	Slow Shut	0.15
B&W	Fast Shut	0.3
	Slow Shut	0.017

3.5 PTZ Mechanical

The CCTV dome camera shall have an integrated motorized PTZ mechanism as specified herein and shall be compatible and coordinated with the control system described elsewhere herein. The camera's 360° pan rotation shall be divided into 16 independent sectors with 16-character titles per sector. Any or all of the 16 sectors may be blanked from the operator. In addition to the blanking function, a privacy masking feature shall be provided that allows creation of up to six (6) rectangular masks that prohibit areas of the field of view from being seen even if the camera is panned, tilted, or zoomed.

Mechanical (Dome Drive)		Requirement
Pan		360°
Tilt		Up to 18° above horizon
Continuous PTZ Operation		Yes
Pre-position speed	Pan	360°/sec
	Tilt	200°/sec
Accuracy	Pan	+/- 0.1°
Variable speed	Pan	80°/sec or 150°/sec
	Tilt	40°/sec

3.6 Functionality

Camera Commands

3.6.1 The camera shall allow the storage of up to 99 preset scenes with each preset programmable for 16 character titles. A tour function shall be available to consecutively display each of the preset scenes for a programmed dwell time. Any or all of the presets may be included or excluded from the tour.

3.6.2 The camera shall be capable of recording two (2) separate tours of an operator's keyboard movements consisting of, tilt, and zoom activities for a total combined duration time of 15 minutes. Recorded tours can be continuously played back.

- 3.6.3 When an operator stops manual control of the camera, and a programmed period of time is allowed to expire, the camera will execute one of the following programmable options: 1) return to preset #1 or 2) return to the automated tour previously executed or 3) do nothing and remain at the present position.
- 3.6.4 The camera shall ensure that any advanced commands required to program the camera are accessed via three levels of password protection ranging from low to high security.
- 3.6.5 The camera system shall provide a feature that automatically rotates, or pivots, the camera to simplify tracking of a person walking directly under the camera.
- 3.6.6 The camera's 360° pan rotation shall be divided into 16 independent sectors with 16-character titles per sector. Any or all of the 16 sectors may be blanked from the operator.
- 3.6.7 In addition to the blanking function, a privacy masking feature shall be provided that allows creation of up to six (6) rectangular masks that prohibit areas of the field of view from being seen even if the camera is panned, tilted, or zoomed

Visual Effects	Requirement
Sectors/Zones	8
Titling	20 characters
Max Presets	99
Motion Detection	Yes
Password Protection	Yes
On Screen Configuration Menus	Yes
Image Stabilization	Yes
Preset Tour / max presets	
Recorded Variable PTZ Tour	2
Auto Flip	Yes
Auto Return to preset after operator inactivity	Yes
Window Blanking	
Quantity	6
Grey out	Yes
Alarms	Yes

- 3.6.8 The manufacturer shall fully document and provide to the Department the communication protocol implemented by the CCTV dome camera. This protocol shall be open and allow third-party development of control software. If the current protocol is not NTCIP compliant, the manufacturer shall supply upgrades to make the software compliant in the future at no cost to the Department.

3.6.9 Diagnostic software shall be provided with each CCTV camera which shall allow all camera functions accessible via a Windows XP based PC. A RS232 cable, or a USB cable if available, shall be provided to connect to CCTV dome camera assembly. A copy of the diagnostic software shall be supplied for each CCTV camera. The program shall be capable of configuring and controlling the CCTV dome camera assembly and its functions (position, zoom, focus, iris, power, color balance, etc.) from within it. This includes storing and recalling preset positions for fast system configuration.

3.7 Interface

Control System. Camera commands shall be transmitted over twisted pair, RS 232, RS 422 and RS 485. The method of transmission shall be user selectable.

The camera shall provide four (4) normally open or normally closed alarm input contacts and one (1) relay output. Any or all of the input contacts may be programmed upon activation to automatically move the camera to any reposition location, close the output relay for a programmed period of time, and display an alarm indication on the on-screen display of the display monitor.

4. TESTING.

The Contractor shall test each CCTV Dome Camera Assembly in the presence of the Engineer after the camera is installed. This test may be done locally at the camera support structure.

5. PRODUCT SUPPORT.

The manufacturer shall provide technical support via email, fax and toll-free telephone. The above forms of support shall be provided Monday through Friday, 8:00am to 8:00pm EST.

6. INSTALLATION.

The Contractor shall submit shop drawings for the camera mounting adapter, and all components used for the installation. The camera shall be installed in accordance with the manufacturer's recommendations.

METHOD OF MEASUREMENT:

The CCTV Dome Video Camera will not be measured. Payment will be made based on the amount bid for the item in the proposal.

BASIS OF PAYMENT:

Payment will be made under:

Pay Item
 CCTV SYSTEM

Payment for the CCTV Dome Video Camera shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

JUNCTION BOX EMBEDDED IN STRUCTURE

DESCRIPTION.

This work shall consist of furnishing and installing an embedded Composite Concrete Junction Box in concrete.

Five nonmetallic junction boxes embedded in structure shall be furnished and installed and shall replace the 5 existing junction boxes on the center median. The size of the junction box shall be no smaller than 24"x30"x9" (height x width x depth) for fiberoptic cable to pass through and shall comply with the bending radius of the fiberoptic cable. Excess 30 ft. slack fiberoptic cable may be stored in the junction box.

MATERIALS.

The box and cover shall be constructed of a polymer concrete and reinforced with a heavy-weave fiberglass cloth. The material shall have the following properties:

Mechanical Property	Value	Physical Property	Value
Compressive strength	9,000 – 15,000 psi	Density	85-150 lbs/ft ²
flexural strength	3,000 – 6,000 psi	Barcol Hardness	45
Impact Energy	30 – 72 ft.-lbs	Water Absorption	Less Than 1%
tensile strength	800 – 1,100 psi		

The resulting enclosure shall have a Tier 8 Load Rating in accordance with ANSI/SCTE 77 2002. The material shall have light gray color to match the surrounding concrete. The cover shall be made of the same material. The junction box and cover shall be arranged to fit flush with the structure surface. The cover shall be gasketed and attached with a minimum of four stainless steel hex-head bolts factory coated with anti-seize compound. The enclosure shall be UL Listed.

INSTALLATION.

The embedded junction box shall be set flush with the adjoining surface and shall be properly supported during concrete placement. The junction box shall not be installed in areas where

Field cut conduit openings shall be uniform and smooth. All burrs and rough edges shall be filed smooth to the satisfaction of the Engineer prior to the installation of conduit(s) into the junction box. Field cut conduit openings shall be fitted with the appropriate conduit fittings and accessories. Conduit fittings and accessories shall be provided according to Article 1088.01 and as shown on the plans.

Conduit openings may be factory cut and pre-assembled with conduit fittings. Conduit fittings and accessories shall be manufactured from polyvinyl chloride complying with ASTM D 1784 and shall comply with all the applicable requirements of NEMA Publication No. TC2, U.L. Standard 651 for EPC-40-PVC and NEC Article 347.

Slight deviations to a larger size than the specified sizes may be allowed to conform to a standard manufacturer's production size with the approval of the Engineer.

METHOD OF MEASUREMENT:

The Junction Box Embedded in Structure will not be measured. Payment will be made based on the amount bid for the item in the proposal.

BASIS OF PAYMENT:

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit.</u>
CCTV SYSTEM	Lump Sum

Payment for the Junction Box Embedded in Structure shall cover the cost of all labor, materials, plants, equipment and incidentals required to completely furnish, install, test, acceptance by local municipalities and place in satisfactory condition the components detailed in accordance with the Plans, Specifications, and directions of the Engineer.

SECTION 801. ELECTRICAL REQUIREMENTS

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."

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 will be paid for separately"

Add the following to Section 801.11(a) of the Standard Specifications:

“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 and 3rd sentences of the second paragraph of Article 801.02 of the Standard Specifications to read:

“Unless otherwise indicated, materials and equipment shall bear the UL label, or an approved equivalent, whenever such labeling is available for the type of material or equipment being furnished.”

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:

- 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:

Description	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	41.584593	-87.793378
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.”

SECTION 810. UNDERGROUND RACEWAYS

Revise Article 810.03 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 810.03 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 810.03 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 810.03(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.

SECTION 811. EXPOSED RACEWAYS

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 810.03(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.”

SECTION 819. TRENCH AND BACKFILL FOR ELECTRICAL WORK

Revise the first sentence of Article 819.03(a) of the Standard Specifications to read:

“Trench. Trenches shall have a minimum depth of 30 in. (760 mm) or as otherwise indicated on the plans, and shall not exceed 12 in. (300 mm) in width without prior approval of the Engineer.”

SECTION 1066. WIRE AND CABLE

Effective: January 1, 2007

Revise the second sentence of the first paragraph of Article 1066.02(a) to read:

“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 second paragraph of Article 1066.02(b) to read:

“Uncoated conductors shall be according to ASTM B3, ICEA S-95-658/NEMA WC70, and UL Standard 44. Coated conductors shall be according to ASTM B 33, ASTM B 8, ICEA S-95-658/NEMA WC70 and UL Standard 44.”

Revise the third paragraph of Article 1066.02(b) to read:

“All conductors shall be stranded. Stranding meeting ASTM B 8, ICEA S-95-658/NEMA WC70 and UL Standard 44. Uncoated conductors meeting ASTM B 3, ICEA S-95-658/NEMA WC70 and UL Standard 44.”

Revise the first sentence of Article 1066.03(a)(1) to read:

“General. Cable insulation designated as XLP shall incorporate cross-linked polyethylene (XLP) insulation as specified and shall meet or exceed the requirements of ICEA S-95-658, NEMA WC70, U.L. Standard 44.”

Add the following to Article 1066.03(a)(1) of the Standard Specifications:

“The cable shall be rated 600 volts and shall be UL Listed Type RHH/RHW/USE.”

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

Revise the first paragraph of Article 1066.03(b) to read:

“EPR Insulation. Cable insulation shall incorporate ethylene propylene rubber (EPR) as specified and the insulation shall meet or exceed the requirements of ICEA S-95-658, NEMA Standard Publication No. WC70, and U.L. Standard 44, as applicable.”

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.”

Revise Article 1066.08 to read:

“Electrical Tape. Electrical tape shall be all weather vinyl plastic tape resistant to abrasion, puncture, flame, oil, acids, alkalies, and weathering, conforming to Federal Specification MIL-I-24391, ASTM D1000 and shall be listed under UL 510 Standard. Thickness shall not be less than 0.215 mm (8.5 mils) and width shall not be less than 20 mm (3/4-inch).”

SECTION 1088. WIREWAY AND CONDUIT SYSTEM

Revise Article 1088.01(a) of the Standard Specifications to read:

“Couplings and fittings shall meet ANSI Standard C80.5 and U.L. Standard 6. Elbows and nipples shall conform to the specifications for conduit. All fittings and couplings for rigid conduit shall be of the threaded type. All conduit hubs shall be gasketed and watertight with an integral O-ring seal.

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.”

**REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS**

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ATTACHMENTS

**A. Employment Preference for Appalachian Contracts
(included in Appalachian contracts only)**

I. GENERAL

1. 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.
2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.
3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.
4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

Section I, paragraph 2;
Section IV, paragraphs 1, 2, 3, 4 and 7;
Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 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 DOL, or the contractor's employees or their representatives.
6. Selection of Labor: During the performance of this contract, the contractor shall not:
 - a. Discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or

- b. Employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

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 and 41 CFR 60 (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 Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American 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 State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.
- b. The contractor will accept as his 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, preapprenticeship, and/or on-the-job-training."

2. EEO Officer: The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for an must be capable of effectively administering and promoting an active contractor program of EEO 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 minority group employees.
- 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 minority groups 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 employees referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish which such identified sources procedures whereby minority group 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, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group 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 his 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 his avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

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. Where feasible, 25 percent of apprentices or trainees in each occupation shall be

in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

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 minority group and women employees 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 his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. 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 best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best 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 SHA 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 minority and women 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 minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) 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 SHA.

8. 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.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees.

Contractors shall obtain lists of DBE construction firms from SHA

personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. 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 completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number 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;

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

(4) The progress and efforts being made in securing the services of

DBE subcontractors or subcontractors with meaningful minority and

female representation among their employees.

b. The contractors will submit an annual report to the SHA 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. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located

on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:

a. All mechanics and laborers 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 (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) 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. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, 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 paragraphs 4 and 5 of this Section IV.

b. 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.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification 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 DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour 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.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional 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 question, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advised the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. Payment of Fringe Benefits:

a. 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 or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any cost 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.

4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:

a. Apprentices:

(1) 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 DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/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 Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees 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

employee 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 listed in 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 or subcontractor 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-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) 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 journeyman-level 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 for the Wage

and Hour Division determines that a different practice prevails for

the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) 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 DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. 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.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level 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-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which cases such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration

withdraws approval of a training program, the contractor or subcontractor 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. Helpers:

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV. 2. Any worker listed on a payroll at a helper wage rate, who is not a helper under a approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. 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.

6. Withholding:

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor 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, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainee's 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 SHA contracting officer 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.

7. Overtime Requirements:

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. Violation:

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her 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, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or

permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. Withholding for Unpaid Wages and Liquidated Damages:

The SHA shall; upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies 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 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

- a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.
- b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof 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. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found 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 and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.
- c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely

all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for submitting payroll copies of all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

- (1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;
- (2) that such 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 the Regulations, 29 CFR 3;
- (3) that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

e. 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 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S. C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, 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 SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions 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.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all federal-aid contracts on the national highway system, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than \$1,000,000 (23 CFR 635) the contractor shall:

- a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.
- b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.
- c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data

required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

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 State. 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 contractors' own organization (23 CFR 635).

- a. "Its own organization" shall be construed to include only workers employed and paid directly 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, assignee, or agent of the prime contractor.
- 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 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 VII 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 SHA 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 SHA 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 SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

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 SHA 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. 333).

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. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

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, the following notice 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:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

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 not more than \$10,000 or imprisoned not more than 5 years or both.”

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more).

By submission of this bid or the execution of this contract, or

subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 *et seq.*, as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 *et seq.*, as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. Instructions for Certification - Primary Covered Transactions:

(Applicable to all Federal-aid contracts - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective primary 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 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 primary 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 department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.
- d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary 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," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal

is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary 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 primary 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 Transaction," provided by the department or agency entering into this covered transaction, without modification in all lower tier covered transactions

and in all solicitations for lower tier covered transactions.

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 may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded from Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. 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.

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.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

- a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- b. Have not within a 3-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;
- c. 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 1b of this certification; and
- d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Covered Transactions:

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

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," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

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.

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 may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

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 dealing.

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.

2. Where the prospective primary participant is unable to certify

Certification Regarding Debarment, Suspension, Ineligibility And Voluntary Exclusion-Lower Tier Covered Transactions:

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 participation in this transaction 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.

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(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 his or her bid or proposal that he or she 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.