



Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

January 9, 2013

SUBJECT: FAP Route 330 (US 12/45)
Project ACNHF-0330(070)
Section 105 WRS&HB
Cook County
Contract No. 60G37
Item No. 104, 1/18/2013 Letting
Addendum A

NOTICE TO PROSPECTIVE BIDDERS:

Attached is an addendum to the plans or proposal. This addendum involves revised and/or added material.

1. Replaced the Schedule of Prices.
2. Revised the Table of Contents to the Special Provisions.
3. Revised pages 2-8, 14-16, 29-32, 41-50, 472-476 & 540-543 of the Special Provisions.
4. Added pages 575- 879 to the Special Provisions.
5. Revised sheets 1, 3, 4, 9-12, 16, 20, 29, 32, 34, 52, 60, 61, 67-69, 89, 92-101, 103, 107-112, 114, 120, 134, 135, 181-183, 186, 189, 192, 291, 300, 304, 313 & 336 of the Plans.
6. Added sheets 605A-605BN to the Plans.

Prime contractors must utilize the enclosed material when preparing their bid and must include any Schedule of Prices changes in their bidding proposal.

Bidders using computer-generated bids are cautioned to reflect any and all Schedule of Prices changes, if involved, into their computer programs.

Very truly yours,

John D. Baranzelli, P. E.
Acting Engineer of Design and Environment

A handwritten signature in black ink, appearing to read 'Ted B. Walschleger P.E.' with a stylized flourish at the end.

By: Ted B. Walschleger, P. E.
Engineer of Project Management

cc: John Fortmann, Region 1, District 1; Dave Lippert, Mike Renner; D.Carl Puzey;
Estimates

MS/ks

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER -

60G37

State Job # - C-91-399-09

Project Number
 ACNHF-0330/070/

Route
 FAP 330

County Name - COOK - -

Code - 31 - -

District - 1 - -

Section Number - 0105 WRS&HB

*REVISED: JANUARY 9, 2013

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
XX008162	MAINTAIN LIGHTING SYS	L SUM	1.000				
X0321809	PERMANENT GRND ANCHOR	EACH	50.000				
X0322916	PRO SS CONN TO EX SS	EACH	6.000				
X0323260	SEDIMENT BASIN	EACH	1.000				
X0324044	EROS CON TEMP P SL DR	EACH	2.000				
X0324085	EM VEH P S LSC 20 3C	FOOT	1,954.000				
X0324455	DRILL/SET SOLD P SOIL	CU FT	7,820.000				
X0324807	CCTV CABINET EQUIPMNT	EACH	2.000				
X0324915	RELOC LT UNIT & POLE	EACH	4.000				
X0325040	FO INNERDUCT 1 1/4"	FOOT	13,619.000				
X0325405	FILL EX STORM SEWERS	CU YD	6.000				
X0326465	MOD EX VID DSTN SYS	L SUM	1.000				
X0326802	UTILITY STRUC REMOVAL	EACH	1.000				
X0326887	WOOD POLE 25 CL 4	EACH	52.000				
X0326945	CCTV CAMERA EQUIPMENT	EACH	1.000				

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X0326948	CCTV CAMERA STR 50 MH	EACH	2.000				
X0326949	CCTV CAMERA ST FD 30D	FOOT	26.000				
X0326955	REM REL EX ELECT SERV	EACH	1.000				
X0326967	REINF CONC DCT BK REM	FOOT	1,950.000				
X0327130	DMS F NTCIP 1203 V2 C	EACH	1.000				
X0327216	CCTV CAMERA	EACH	3.000				
X0327332	FIB CONN IDOT DIST 1	L SUM	1.000				
X0327349	TEMP WP 40 CL 4	EACH	10.000				
X0327516	2-WAY 2-5 PVC DB 1X2	FOOT	480.000				
X0327517	15-WAY15-5 PVC DB 5X3	FOOT	1,120.000				
*ADD X0327519	INNERDUCT 1 SW SDR11	FOOT	37,600.000				
*ADD X0327520	FAA ELECT HANDHOLE	EACH	14.000				
*ADD X0327521	N C EX FAA MN/HH	EACH	10.000				
*ADD X0327522	AGG SURF CSE CA-4 6	SQ YD	130.000				
*ADD X0327523	INST N MR MG30 L T-C	EACH	1.000				

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*ADD X0327524	12-S B MM FO CAB OUT	FOOT	8,500.000				
*ADD X0327525	MM FO PATCH PAN 72 P	EACH	2.000				
*ADD X0327526	IN T-ALSF2 MG20 LT-C	EACH	1.000				
*ADD X0327527	REL ALSF2 MG20 LT-C	EACH	1.000				
*ADD X0327528	ADJ WN BKT ALSF2 T-C	EACH	1.000				
*ADD X0327529	ALSF2 F CC 12P#19 SH	FOOT	350.000				
*ADD X0327530	PC-L824 C-5KV 1#6AWG	FOOT	8,200.000				
*ADD X0327531	GW-1 #6AWG 600V TN G	FOOT	1,000.000				
*ADD X0327532	GU W-1 1AWG 600V B C	FOOT	2,440.000				
*ADD X0327533	TRC W1 14AWG S IN OR	FOOT	8,500.000				
*ADD X0327534	CON-ALSF2 FL PWR CAB	FOOT	350.000				
*ADD X0327535	DB 2W 2PVC-C CONC EN	FOOT	8.000				
*ADD X0327536	DB 2W 3PVC-C CONC EN	FOOT	15.000				
*ADD X0327537	DB 2W 4PVC-C CONC EN	FOOT	2,150.000				
*ADD X0327538	DB 5W PVCC 6-SP C EN	FOOT	100.000				

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*ADD X0327539	DB 6W 2PVCC 6SP C EN	FOOT	120.000				
*ADD X0327540	DB 7W 2PVCC GRSC D B	FOOT	190.000				
*ADD X0327541	DB 2W 4PVCC GRSC D B	FOOT	726.000				
X0335700	P.S. GENERAL WORK	L SUM	1.000				
X0426200	DEWATERING	L SUM	1.000				
X2011000	TEMPORARY FENCE SPL	FOOT	600.000				
*ADD X4022000	TEMP ACCESS- COM ENT	EACH	1.000				
*ADD X4023000	TEMP ACCESS- ROAD	EACH	1.000				
X4201050	HES PCC PVT 10 3/4 J	SQ YD	275.000				
X4403700	MEDIAN REM SPL	SQ FT	14,273.000				
X5030230	SPECIAL STRUCTURE	EACH	2.000				
X6020084	MANHOLE SPECIAL	EACH	3.000				
X6020090	MANOLE W/RESTRICT PLT	EACH	2.000				
X6060097	CLASS SI CONC OUT SPL	CU YD	8.000				
X6061005	CONC CURB TB SPL	FOOT	174.000				

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X6061902	CONC MED TSM SPL	SQ FT	5,783.000				
X6640535	CH LK FENCE 6 ATT STR	FOOT	595.000				
X6640560	CH LK FENCE 6 SPL	FOOT	85.000				
X7010216	TRAF CONT & PROT SPL	L SUM	1.000				
X7011015	TR C-PROT EXPRESSWAYS	L SUM	1.000				
X7030025	WET REF TEM TP T3 L&S	SQ FT	411.000				
X7030030	WET REF TEM TAPE T3 4	FOOT	102,320.000				
X7030040	WET REF TEM TAPE T3 6	FOOT	2,444.000				
X7030045	WET REF TEM TAPE T3 8	FOOT	11,106.000				
X7030050	WET REF TEM TPE T3 12	FOOT	682.000				
X7030055	WET REF TEM TPE T3 24	FOOT	542.000				
X7040650	REM TEMP CONC BARRIER	FOOT	197.000				
X7330064	SIGN SUPPORT SPL	EACH	2.000				
X8040500	RELOC ELECT SERVICE	L SUM	1.000				
X8050095	SERV INSTALL SPL	EACH	2.000				

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X8140105	HANDHOLE SPL	EACH	1.000				
X8140225	HANDHOLE PCC SPL	EACH	4.000				
X8250500	LIGHTING UNIT COMP SP	EACH	7.000				
X8251388	LT CT BM 480V200D RS	EACH	2.000				
X8300001	LIGHT P0LE SPECIAL	EACH	15.000				
X8300415	LP SS 15MH	EACH	15.000				
X8300420	LP SS 17.5MH	EACH	56.000				
X8301051	MA ALUM 20FT	EACH	52.000				
X8570226	FAC T4 CAB SPL	EACH	2.000				
X8620200	UNINTER POWER SUP SPL	EACH	2.000				
X8710024	FOCC62.5/125 MM12SM24	FOOT	4,118.000				
X8710035	FIB OPT CBL 96F SM	FOOT	12,462.000				
X8710036	FIB OPT CBL 12F SM	FOOT	1,029.000				
X8710071	FIB OPT FUSION SPLICE	EACH	3.000				
X8780105	CONC FDN SPL	EACH	1.000				

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X8950077	REM REL EXIST LT CONT	EACH	1.000				
Z0004002	BOLLARDS	EACH	11.000				
Z0007118	UNTREATED TIMBER LAG	SQ FT	6,965.000				
Z0013798	CONSTRUCTION LAYOUT	L SUM	1.000				
Z0016702	DETOUR SIGNING	L SUM	1.000				
Z0022800	FENCE REMOVAL	FOOT	1,150.000				
Z0023500	FILL EXIST CULVERTS	CU YD	2.000				
Z0026402	FUR SOLDIER PILES HP	FOOT	1,746.000				
Z0026404	FUR SOLDIER PILES WS	FOOT	743.000				
Z0030850	TEMP INFO SIGNING	SQ FT	2,249.000				
Z0033020	LUM SFTY CABLE ASMBLY	EACH	126.000				
Z0033046	RE-OPTIMIZE SIG SYS 2	EACH	2.000				
Z0033052	COMMUNICATIONS VAULT	EACH	4.000				
Z0046306	P UNDR FOR STRUCT 6	FOOT	1,477.000				
Z0056608	STORM SEW WM REQ 12	FOOT	74.000				

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Z0056616	STORM SEW WM REQ 24	FOOT	20.000				
Z0056626	STORM SEW WM REQ 48	FOOT	40.000				
Z0062456	TEMP PAVEMENT	SQ YD	41,660.000				
Z0062458	TEMP PAVEMT VAR DEPTH	TON	690.000				
Z0073002	TEMP SOIL RETEN SYSTM	SQ FT	4,020.000				
Z0073510	TEMP TR SIGNAL TIMING	EACH	2.000				
Z0076600	TRAINEES	HOUR	2,000.000		0.800		1,600.000
Z0076604	TRAINEES TPG	HOUR	2,000.000		10.000		20,000.000
20100110	TREE REMOV 6-15	UNIT	836.000				
20100210	TREE REMOV OVER 15	UNIT	140.000				
20101100	TREE TRUNK PROTECTION	EACH	14.000				
20101700	SUPPLE WATERING	UNIT	8.000				
20200100	EARTH EXCAVATION	CU YD	162,409.000				
20201200	REM & DISP UNS MATL	CU YD	18,535.000				
20800150	TRENCH BACKFILL	CU YD	4,916.000				

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20900110	POROUS GRAN BACKFILL	CU YD	2,365.000				
21001000	GEOTECH FAB F/GR STAB	SQ YD	130,713.000				
21101505	TOPSOIL EXC & PLAC	CU YD	1,871.000				
21101625	TOPSOIL F & P 6	SQ YD	64,486.000				
21101685	TOPSOIL F & P 24	SQ YD	7,497.000				
25000210	SEEDING CL 2A	ACRE	9.500				
25000310	SEEDING CL 4	ACRE	5.400				
25000400	NITROGEN FERT NUTR	POUND	1,341.000				
25000500	PHOSPHORUS FERT NUTR	POUND	1,341.000				
25000600	POTASSIUM FERT NUTR	POUND	1,341.000				
25100630	EROSION CONTR BLANKET	SQ YD	70,097.000				
25100900	TURF REINF MAT	SQ YD	3,772.000				
28000250	TEMP EROS CONTR SEED	POUND	1,489.000				
28000305	TEMP DITCH CHECKS	FOOT	391.000				
28000400	PERIMETER EROS BAR	FOOT	14,011.000				

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28000500	INLET & PIPE PROTECT	EACH	16.000				
28000510	INLET FILTERS	EACH	163.000				
28001100	TEMP EROS CONTR BLANK	SQ YD	70,097.000				
28100105	STONE RIPRAP CL A3	SQ YD	23.000				
28200200	FILTER FABRIC	SQ YD	23.000				
30300001	AGG SUBGRADE IMPROVE	CU YD	5,259.000				
30300112	AGG SUBGRADE IMPR 12	SQ YD	130,314.000				
31200502	STAB SUBBASE HMA 4.5	SQ YD	135,816.000				
35400500	PCC BASE CSE W 10	SQ YD	461.000				
40200800	AGG SURF CSE B	TON	104.000				
40300100	BIT MATLS PR CT	GALLON	50.000				
40600115	P BIT MATLS PR CT	GALLON	1,853.000				
40603080	HMA BC IL-19.0 N50	TON	147.000				
40603240	P HMA BC IL19.0 N90	TON	760.000				
40603335	HMA SC "D" N50	TON	49.000				

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40603595	P HMA SC "F" N90	TON	591.000				
42000501	PCC PVT 10 JOINTED	SQ YD	4,065.000				
42000516	PCC PVT 10 3/4 JOINTD	SQ YD	85,190.000				
42001300	PROTECTIVE COAT	SQ YD	90,089.000				
42400200	PC CONC SIDEWALK 5	SQ FT	2,847.000				
44000100	PAVEMENT REM	SQ YD	103,253.000				
44000165	HMA SURF REM 4	SQ YD	5,567.000				
44000500	COMB CURB GUTTER REM	FOOT	3,673.000				
44004000	PAVED DITCH REMOVAL	FOOT	582.000				
44004250	PAVED SHLD REMOVAL	SQ YD	31,567.000				
44201771	CL D PATCH T4 10	SQ YD	390.000				
44300200	STRIP REF CR CON TR	FOOT	500.000				
48101620	AGGREGATE SHLDS B 10	SQ YD	1,722.000				
48203040	HMA SHOULDERS 10 3/4	SQ YD	1,093.000				
48300500	PCC SHOULDERS 10	SQ YD	2,730.000				

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48300515	PCC SHOULDERS 10 3/4	SQ YD	25,872.000				
50200100	STRUCTURE EXCAVATION	CU YD	9,505.000				
50200450	REM/DISP UNS MATL-STR	CU YD	885.000				
*REV 50300225	CONC STRUCT	CU YD	2,260.100				
50300255	CONC SUP-STR	CU YD	1,240.700				
50300260	BR DECK GROOVING	SQ YD	2,688.000				
50300285	FORM LINER TEX SURF	SQ FT	7,774.000				
50300300	PROTECTIVE COAT	SQ YD	10,224.000				
50500305	ERECT STRUCT STEEL	L SUM	1.000				
50500505	STUD SHEAR CONNECTORS	EACH	10,465.000				
*REV 50800205	REINF BARS, EPOXY CTD	POUND	500,880.000				
50800515	BAR SPLICERS	EACH	719.000				
*ADD 50901760	PIPE HANDRAIL	FOOT	45.000				
51100100	SLOPE WALL 4	SQ YD	1,670.000				
51500100	NAME PLATES	EACH	2.000				

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52000030	PREF JOINT SEAL 2 1/2	FOOT	126.000				
52000110	PREF JT STRIP SEAL	FOOT	368.000				
52100210	ERECT ELAS BRG ASY T1	EACH	20.000				
52100520	ANCHOR BOLTS 1	EACH	40.000				
52100530	ANCHOR BOLTS 1 1/4	EACH	40.000				
*DEL 542A0217	P CUL CL A 1 12	FOOT	61.000				
*ADD 542A0220	P CUL CL A 1 15	FOOT	61.000				
*DEL 54213657	PRC FLAR END SEC 12	EACH	3.000				
54213687	PRC FLAR END SEC 42	EACH	1.000				
*ADD 54261430	CONC ES 542001 30 1:4	EACH	1.000				
*ADD 54261615	CONC ES 542001 15 1:6	EACH	3.000				
*ADD 54261624	CONC ES 542001 24 1:6	EACH	2.000				
*ADD 54261630	CONC ES 542001 30 1:6	EACH	1.000				
550A0050	STORM SEW CL A 1 12	FOOT	407.000				
550A0090	STORM SEW CL A 1 18	FOOT	187.000				

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550A0140	STORM SEW CL A 1 30	FOOT	64.000				
550A0340	STORM SEW CL A 2 12	FOOT	4,587.000				
550A0360	STORM SEW CL A 2 15	FOOT	26.000				
550A0380	STORM SEW CL A 2 18	FOOT	1,721.000				
550A0410	STORM SEW CL A 2 24	FOOT	806.000				
550A0430	STORM SEW CL A 2 30	FOOT	246.000				
550A0450	STORM SEW CL A 2 36	FOOT	1,726.000				
550A0470	STORM SEW CL A 2 42	FOOT	758.000				
550A0640	STORM SEW CL A 3 12	FOOT	171.000				
550A0660	STORM SEW CL A 3 15	FOOT	72.000				
550A0710	STORM SEW CL A 3 24	FOOT	497.000				
550A0770	STORM SEW CL A 3 42	FOOT	416.000				
550A0780	STORM SEW CL A 3 48	FOOT	1,356.000				
*REV 550A1080	STORM SEW CL A 4 48	FOOT	2,684.000				
*ADD 550A1950	STORM SEW CL A 7 48	FOOT	353.000				

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55100200	STORM SEWER REM 6	FOOT	25.000				
55100300	STORM SEWER REM 8	FOOT	219.000				
55100400	STORM SEWER REM 10	FOOT	1,956.000				
55100500	STORM SEWER REM 12	FOOT	2,541.000				
55100700	STORM SEWER REM 15	FOOT	1,119.000				
55100900	STORM SEWER REM 18	FOOT	229.000				
55101200	STORM SEWER REM 24	FOOT	2,014.000				
55101400	STORM SEWER REM 30	FOOT	780.000				
55101600	STORM SEWER REM 36	FOOT	251.000				
55101900	STORM SEWER REM 48	FOOT	1,346.000				
55201600	STORM SEWERS JKD 48	FOOT	115.000				
58700300	CONCRETE SEALER	SQ FT	2,410.000				
59100100	GEOCOMPOSITE WALL DR	SQ YD	2,117.000				
60100081	SHOULDER REM/REPL 12	FOOT	600.000				
60200105	CB TA 4 DIA T1F OL	EACH	1.000				

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60200805	CB TA 4 DIA T8G	EACH	6.000				
60201310	CB TA 4 DIA T20F&G	EACH	12.000				
60201340	CB TA 4 DIA T24F&G	EACH	124.000				
60204505	CB TA 5 DIA T8G	EACH	1.000				
60218400	MAN TA 4 DIA T1F CL	EACH	8.000				
60221000	MAN TA 5 DIA T1F OL	EACH	1.000				
60221100	MAN TA 5 DIA T1F CL	EACH	29.000				
60223700	MAN TA 6 DIA T1F OL	EACH	2.000				
60223800	MAN TA 6 DIA T1F CL	EACH	17.000				
60224459	MAN TA 8 DIA T1F CL	EACH	2.000				
60247160	DR STR T1 W/2 T20F&G	EACH	13.000				
60247170	DR STR T2 W/2 T22F&G	EACH	1.000				
60250200	CB ADJUST	EACH	1.000				
60255500	MAN ADJUST	EACH	2.000				
60260100	INLETS ADJUST	EACH	1.000				

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60500040	REMOV MANHOLES	EACH	56.000				
60500050	REMOV CATCH BAS	EACH	18.000				
60500060	REMOV INLETS	EACH	28.000				
60602800	CONC GUTTER TB	FOOT	330.000				
60603800	COMB CC&G TB6.12	FOOT	854.000				
60605000	COMB CC&G TB6.24	FOOT	1,512.000				
60608521	COMB CC&G TM2.24	FOOT	100.000				
60608582	COMB CC&G TM4.24	FOOT	17,591.000				
60619600	CONC MED TSB6.12	SQ FT	965.000				
60622320	CONC MED TSM4.24	SQ FT	1,305.000				
60623200	CONC MED TSM6.24	SQ FT	929.000				
63000001	SPBGR TY A 6FT POSTS	FOOT	1,648.000				
63100045	TRAF BAR TERM T2	EACH	1.000				
63100070	TRAF BAR TERM T5	EACH	2.000				
63100085	TRAF BAR TERM T6	EACH	2.000				

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63100167	TR BAR TRM T1 SPL TAN	EACH	2.000				
63100169	TR BAR TRM T1 SPL FLR	EACH	3.000				
63200310	GUARDRAIL REMOV	FOOT	9,229.000				
63301210	REM RE-E SPBGR TY A	FOOT	442.000				
63700155	CONC BAR 1F 32HT	FOOT	700.000				
63700255	CONC BAR 2F 32HT	FOOT	3,760.000				
63700900	CONC BARRIER BASE	FOOT	4,600.000				
64300260	IMP ATTEN FRD NAR TL3	EACH	3.000				
64300530	IMP ATTEN PRD TL3	EACH	1.000				
*ADD 66407400	CH LK GATES 6X8 DBL	EACH	1.000				
*ADD 66900200	NON SPL WASTE DISPOSL	CU YD	132,000.000				
*ADD 66900400	SPL WAST GRD WAT DISP	GALLON	3,424,000.000				
*ADD 66900450	SPL WASTE PLNS/REPORT	L SUM	1.000				
*ADD 66900530	SOIL DISPOSAL ANALY	EACH	10.000				
*ADD 66901000	BACKFILL PLUGS	CU YD	210.000				

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67000400	ENGR FIELD OFFICE A	CAL MO	20.000				
67000600	ENGR FIELD LAB	CAL MO	20.000				
67100100	MOBILIZATION	L SUM	1.000				
70103815	TR CONT SURVEILLANCE	CAL DA	464.000				
70106800	CHANGEABLE MESSAGE SN	CAL MO	151.000				
70300210	TEMP PVT MK LTR & SYM	SQ FT	169.000				
70300220	TEMP PVT MK LINE 4	FOOT	69,459.000				
70300240	TEMP PVT MK LINE 6	FOOT	1,270.000				
70300250	TEMP PVT MK LINE 8	FOOT	4,826.000				
70300260	TEMP PVT MK LINE 12	FOOT	341.000				
70300280	TEMP PVT MK LINE 24	FOOT	185.000				
70301000	WORK ZONE PAVT MK REM	SQ FT	67,874.000				
70400100	TEMP CONC BARRIER	FOOT	15,872.000				
70400200	REL TEMP CONC BARRIER	FOOT	13,534.000				
70500665	TEMP TR BAR TERM T6	EACH	1.000				

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*REV 70600250	IMP ATTN TEMP NRD TL3	EACH	3.000				
*ADD 70600251	IMP ATTN TEMP NRN TL3	EACH	7.000				
70600280	IMP ATTN TEMP SUN TL3	EACH	4.000				
70600290	IMP ATTN TEMP SUW TL3	EACH	3.000				
*ADD 70600320	IMP ATTN REL FRD TL2	EACH	6.000				
70600350	IMP ATTN REL NRD TL3	EACH	6.000				
72000100	SIGN PANEL T1	SQ FT	485.000				
72000200	SIGN PANEL T2	SQ FT	438.000				
72000300	SIGN PANEL T3	SQ FT	2,362.000				
72400100	REMOV SIN PAN ASSY TA	EACH	6.000				
72400200	REMOV SIN PAN ASSY TB	EACH	8.000				
72400310	REMOV SIGN PANEL T1	SQ FT	482.000				
72400320	REMOV SIGN PANEL T2	SQ FT	304.000				
72400330	REMOV SIGN PANEL T3	SQ FT	1,470.000				
72400710	RELOC SIGN PANEL T1	SQ FT	3.000				

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72400720	RELOC SIGN PANEL T2	SQ FT	20.000				
72400730	RELOC SIGN PANEL T3	SQ FT	300.000				
72700100	STR STL SIN SUP BA	POUND	3,432.000				
72900100	METAL POST TY A	FOOT	438.000				
72900200	METAL POST TY B	FOOT	202.000				
73300200	OVHD SIN STR-SPAN T2A	FOOT	289.000				
73301805	OSS BUTFLY TY III-F-A	FOOT	32.000				
73301810	OSS WALKWAY TY A	FOOT	32.000				
73302210	OSS CANT 3CA 3-0X7-0	FOOT	67.000				
73400100	CONC FOUNDATION	CU YD	25.000				
73400200	DRILL SHAFT CONC FDN	CU YD	100.000				
73600100	REMOV OH SIN STR-SPAN	EACH	1.000				
73700300	REM CONC FDN-OVHD	EACH	2.000				
78000100	THPL PVT MK LTR & SYM	SQ FT	73.000				
78000200	THPL PVT MK LINE 4	FOOT	2,315.000				

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78000400	THPL PVT MK LINE 6	FOOT	134.000				
78008200	POLYUREA PM T1 LTR-SY	SQ FT	898.000				
78008210	POLYUREA PM T1 LN 4	FOOT	50,755.000				
78008230	POLYUREA PM T1 LN 6	FOOT	3,813.000				
78008240	POLYUREA PM T1 LN 8	FOOT	6,263.000				
78008250	POLYUREA PM T1 LN 12	FOOT	1,407.000				
78008270	POLYUREA PM T1 LN 24	FOOT	300.000				
78100100	RAISED REFL PAVT MKR	EACH	976.000				
78100105	RAISED REF PVT MKR BR	EACH	62.000				
78200430	GUARDRAIL MKR TYPE C	EACH	10.000				
78200530	BAR WALL MKR TYPE C	EACH	1,095.000				
78201000	TERMINAL MARKER - DA	EACH	4.000				
*REV 78300100	PAVT MARKING REMOVAL	SQ FT	47,907.000				
78300200	RAISED REF PVT MK REM	EACH	917.000				
80400100	ELECT SERV INSTALL	EACH	4.000				

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80400200	ELECT UTIL SERV CONN	L SUM	1.000		20,000.000		20,000.000
81023300	CON ENC C 2 PVC 2X1	FOOT	1,200.000				
81028200	UNDRGRD C GALVS 2	FOOT	1,568.000				
81028210	UNDRGRD C GALVS 2 1/2	FOOT	263.000				
81028220	UNDRGRD C GALVS 3	FOOT	1,960.000				
81028230	UNDRGRD C GALVS 3 1/2	FOOT	298.000				
81028240	UNDRGRD C GALVS 4	FOOT	8,069.000				
81028340	UNDRGRD C PVC 1 1/2	FOOT	125.000				
81028730	UNDRGRD C CNC 1 1/4	FOOT	2,750.000				
81100220	CON AT ST 3/4 PVC GS	FOOT	1,500.000				
81100510	CON AT ST 1.5 GS PVC	FOOT	400.000				
81100800	CON AT ST 3 GALVS	FOOT	20.000				
81200200	CON EMB STR 3/4 PVC	FOOT	110.000				
81200215	CON EMB STR 1.25 PVC	FOOT	420.000				
81200230	CON EMB STR 2 PVC	FOOT	765.000				

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81200250	CON EMB STR 3 PVC	FOOT	8,656.000				
81200270	CON EMB STR 4 PVC	FOOT	9,444.000				
81300555	JUN BX SS AS 12X12X8	EACH	8.000				
81300730	JUN BX SS AS 16X14X6	EACH	2.000				
81301370	JUN BX SS ES 18X12X8	EACH	5.000				
81304000	JUN BOX EM S 8X8X6	EACH	8.000				
81304800	JUN BOX EM S 18X18X10	EACH	6.000				
81400100	HANDHOLE	EACH	23.000				
81400200	HD HANDHOLE	EACH	6.000				
81400300	DBL HANDHOLE	EACH	4.000				
81400730	HANDHOLE C CONC	EACH	2.000				
81603081	UD 3#2#4GXLP USE 1.5 P	FOOT	19,526.000				
81702110	EC C XLP USE 1C 10	FOOT	1,600.000				
81702120	EC C XLP USE 1C 8	FOOT	20,274.000				
81702130	EC C XLP USE 1C 6	FOOT	5,988.000				

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81702140	EC C XLP USE 1C 4	FOOT	3,900.000				
81702150	EC C XLP USE 1C 2	FOOT	495.000				
81702180	EC C XLP USE 1C 3/0	FOOT	150.000				
81702200	EC C XLP USE 1C 250	FOOT	149.000				
81702400	EC C XLP USE 3-1C 2	FOOT	482.000				
81800300	A CBL 3-1C2 MESS WIRE	FOOT	26,437.000				
82102250	LUM SV HOR MT 250W	EACH	52.000				
82102310	LUM SV HOR MT 310W	EACH	161.000				
82102400	LUM SV HOR MT 400W	EACH	28.000				
82107100	UNDERPAS LUM 70W HPS	EACH	7.000				
82107200	UNDERPAS LUM 100W HPS	EACH	143.000				
82107700	UNDERPAS LUM 400W HPS	EACH	27.000				
82500350	LT CONT BASEM 240V100	EACH	1.000				
83001250	LT P A 35MH 6DA-TW	EACH	1.000				
83002600	LT P A 40MH 15DA	EACH	10.000				

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83050825	LT P A 47.5MH 15DA	EACH	62.000				
83050915	LT P A 47.5MH 2-6DA	EACH	9.000				
83057295	LT P WD 50 CL4 15MA	EACH	102.000				
83600200	LIGHT POLE FDN 24D	FOOT	1,260.000				
83600352	LP F M 11.5BC 8 5/8X6	EACH	18.000				
83800105	BKWY DEV TR B 11.5BC	EACH	119.000				
83800205	BKWY DEV TR B 15BC	EACH	80.000				
84100110	REM TEMP LIGHT UNIT	EACH	161.000				
84200500	REM LT UNIT SALV	EACH	202.000				
84200804	REM POLE FDN	EACH	141.000				
84400105	RELOC EX LT UNIT	EACH	3.000				
84500110	REMOV LIGHTING CONTR	EACH	2.000				
84500120	REMOV ELECT SERV INST	EACH	2.000				
84500130	REMOV LTG CONTR FDN	EACH	1.000				
85000200	MAIN EX TR SIG INSTAL	EACH	1.000				

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86400100	TRANSCEIVER - FIB OPT	EACH	2.000				
87300925	ELCBL C TRACER 14 1C	FOOT	4,118.000				
87301225	ELCBL C SIGNAL 14 3C	FOOT	2,033.000				
87301245	ELCBL C SIGNAL 14 5C	FOOT	7,442.000				
87301255	ELCBL C SIGNAL 14 7C	FOOT	1,435.000				
87301305	ELCBL C LEAD 14 1PR	FOOT	7,969.000				
87301805	ELCBL C SERV 6 2C	FOOT	75.000				
87301900	ELCBL C EGRDC 6 1C	FOOT	2,725.000				
87502480	TS POST GALVS 14	EACH	2.000				
87502500	TS POST GALVS 16	EACH	2.000				
87700140	S MAA & P 20	EACH	1.000				
87700200	S MAA & P 32	EACH	2.000				
87700270	S MAA & P 46	EACH	1.000				
87702960	STL COMB MAA&P 46	EACH	1.000				
87703020	STL COMB MAA&P 58	EACH	2.000				

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87800100	CONC FDN TY A	FOOT	24.000				
87800150	CONC FDN TY C	FOOT	8.000				
87800400	CONC FDN TY E 30D	FOOT	10.000				
87800415	CONC FDN TY E 36D	FOOT	48.000				
87800420	CONC FDN TY E 42D	FOOT	42.000				
87900200	DRILL EX HANDHOLE	EACH	2.000				
88030012	SH LED 1F 1S BM	EACH	1.000				
88030020	SH LED 1F 3S MAM	EACH	16.000				
88030050	SH LED 1F 3S BM	EACH	2.000				
88030070	SH LED 1F 4S BM	EACH	1.000				
88030100	SH LED 1F 5S BM	EACH	1.000				
88030110	SH LED 1F 5S MAM	EACH	3.000				
88030210	SH LED 2F 3S BM	EACH	2.000				
88030240	SH LED 2F 1-3 1-5 BM	EACH	2.000				
88200210	TS BACKPLATE LOU ALUM	EACH	21.000				

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88500100	INDUCTIVE LOOP DETECT	EACH	23.000				
88600100	DET LOOP T1	FOOT	228.000				
88600700	PREFORM DETECT LOOP	FOOT	1,839.000				
89000100	TEMP TR SIG INSTALL	EACH	2.000				
89501400	REL EM VEH PR SYS D U	EACH	6.000				
89501410	REL EM VEH PR SYS P U	EACH	2.000				
89502200	MOD EX CONTR	EACH	1.000				
89502300	REM ELCBL FR CON	FOOT	1,010.000				
89502375	REMOV EX TS EQUIP	EACH	2.000				
89502380	REMOV EX HANDHOLE	EACH	38.000				
89502385	REMOV EX CONC FDN	EACH	20.000				

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COORDINATION WITH ADJACENT AND/OR OVERLAPPING CONTRACTS

This contract abuts and/or overlaps with other concurrent contracts listed below and are expected to be built simultaneously. Each contract includes work items requiring close coordination between the various Contractors regarding the sequence and timing of execution of work items. This contract also includes critical work items that affect the future staging of traffic and completion dates of other contracts.

Contract No. 60P35 – Mannheim Road North from I-190 to north of Higgins Road (IL 72). Widening and reconstruction, traffic signals, culvert, storm sewer, lighting, pavement marking and signing.

Critical items affecting the above contract: MOT coordination, Box Culvert Construction, Ramp Closures and Detours.

The staging and traffic control shown on the plans near the project limit with Contract 60P35 is based on both contracts being in construction at the same time as this contract. Adjustments to the staging and traffic control shown may be required. The contractor shall coordinate construction staging and traffic control work with adjoining or overlapping contracts, including barricade placement necessary to provide a uniform traffic pattern in accordance with the standards and details in the plans and as directed by the Engineer.

I-190 ATS BRIDGE PIER RELOCATION – Bridge pier relocation and associated electrical and train control work for the Airport Transit System (ATS) Bridge over Interstate I-190.

Critical items affecting the above contract: FAA FOTS Loop 3 relocation must be in place prior to ATS shutdown.

BALMORAL EXTENSION - Stage 3 of the Balmoral Avenue Improvement Project. Proposed improvements include construction of a new bridge overpass over Mannheim Road mainline.

Critical items affecting the above contract: Placement of overhead structural beams and construction of bridge substructure elements.

IL 19 and YORK ROAD – Mannheim Road will be a signed detour route and the contractor will have to work around signs placed on this route. If the signs need to be relocated during construction, the contractor must coordinate with the RE from each project.

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Add the following paragraph to the beginning of Article 105.08; "The Contractor shall identify all such work items (including the critical items listed above) at the beginning of the contract and coordinate the sequence and timing of their execution and completion with the other Contractor through the Engineer. All of these work items shall be identified as separate line items in the Contractor's proposed Construction Progress Schedule. Additional compensation or the extension of contract time will not be allowed for the progress of work items affected by the lack of such coordination by the Contractor".

INTERIM AND FINAL COMPLETION DATE PLUS WORKING DAYS

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

When an interim completion date is specified, the Contractor shall complete all contract items related to the relocation of the FAA MOTS Loop 3 fiber optic cable by **October 1, 2013** as specified in the contract plans and special provisions.

When a completion date plus working days is specified, the Contractor shall complete all contract items and safely open all roadways to traffic by **August 29, 2014** except as specified herein.

The Contractor will be allowed to complete all clean-up work and punch list items within **5** working days after the completion date for opening the roadway to traffic. Under extenuating circumstances the Engineer may direct that certain items of work, not affecting the safe opening of the roadway to traffic, may be completed within the working days allowed for clean-up work and punch list items. Temporary lane closures for this work may be allowed at the discretion of the Engineer.

The Special Provision for "Failure to Complete the Work on Time" shall apply to the interim completion date, the final completion date, and the number of working days.

FAILURE TO COMPLETE THE WORK ON TIME (D-1)

Effective: September 30, 1985

Revised: January 1, 2007

Should the Contractor fail to complete the work on or before the **interim completion date, final completion date, or working days** as specified in the Special Provisions for "Interim Completion Date" or "Completion Date Plus Working Days", or within such extended time as may have been allowed by the Department, the Contractor shall be liable to the Department in the amount of **\$5,800**, 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.

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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.

MAINTENANCE OF ROADWAYS (D-1)

Effective: September 30, 1985

Revised: November 1, 1996

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

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

KEEPING THE EXPRESSWAY OPEN TO TRAFFIC (D-1)

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 a work week of Monday through Friday and shall not include weekends or Holidays.

Revised 1/8/2013

LOCATION: I-190 from Bessie Coleman Drive to River Rd.

WEEK NIGHT	TYPE OF CLOSURE	ALLOWABLE LANE CLOSURE HOURS		
Sunday thru Friday	One Lane Two Lanes	10:00 P.M. 11:00 P.M.	to to	5:00 A.M. 5:00 A.M.
Saturday	One Lane Two Lanes	10:00 P.M. (Sat.) 11:00 P.M. (Sat.)	to to	7:00 A.M. (Sun.) 7:00 A.M. (Sun.)

Temporary full ramp closures to and from I-190 will only be allowed during the allowable hours for a 2 lane closure.

In addition to the hours noted above, temporary shoulder and partial ramp closures are allowed weekdays between 9:00 AM and 3:00 PM.

In addition to other restrictions on lane closures and shoulder closures found in the contract these additional restrictions apply: during the following holiday periods no lane closures or shoulder closures will be allowed on I-190 or the ramps to and from I-190 and Mannheim Road. Also no work will be allowed that interferes with height restrictions near or around the airport.

- 3:00 p.m. Friday, November 22, 2013 to 9:00 a.m. Monday, December 2, 2013
- 3:00 p.m. Friday, December 20, 2013 to 11:59 p.m. Sunday, January 5, 2014

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.

Revised 1/8/2013

FAILURE TO OPEN TRAFFIC LANES TO TRAFFIC (D-1)

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 = \$ **1,800**

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 PLAN (D-1)

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.

Revised 1/8/2013

PLANS:

MAINTENANCE OF TRAFFIC PLAN SHEETS

STANDARDS:

- 701001-02 OFF-ROAD OPERATIONS, 2L, 2W, MORE THAN 15' (4.5 M) AWAY
- 701006-04 OFF-ROAD OPERATIONS, 2L, 2W, 15' (4.5 M) TO 24" (600 MM) FROM PAVEMENT EDGE
- 701011-03 OFF-ROAD MOVING OPERATIONS, 2L, 2W, DAY ONLY
- 701101-03 OFF-ROAD OPERATIONS, MULTILANE, 15' (4.5 M) TO 24" (600 MM) FROM PAVEMENT EDGE
- 701106-02 OFF-ROAD OPERATIONS, MULTILANE, MORE THAN 15' (4.5 M) AWAY
- 701411-08 LANE CLOSURE, MULTILANE, AT ENTRANCE OR EXIT RAMP, FOR SPEEDS \geq 45 MPH
- 701421-05 LANE CLOSURE, MULTILANE, DAY OPERATIONS ONLY, FOR SPEEDS \geq 45 MPH TO 55 MPH
- 701422-05 LANE CLOSURE, MULTILANE, FOR SPEEDS \geq 45 MPH TO 55 MPH
- 701426-05 LANE CLOSURE, MULTILANE, INTERMITTENT OR MOVING OPERATION, FOR SPEEDS \geq 45 MPH
- 701427-01 LANE CLOSURE, MULTILANE, INTERMITTENT OR MOVING OPERATION, FOR SPEEDS \leq 40 MPH
- 701501-06 URBAN LANE CLOSURE, 2L, 2W, UNDIVIDED
- 701601-08 URBAN LANE CLOSURE, MULTILANE, 1W OR 2W WITH NONTRAVERSABLE MEDIAN
- 701701-08 URBAN LANE CLOSURE, MULTILANE INTERSECTION
- 701801-05 **SIDEWALK, CORNER OR CROSSWALK CLOSURE**
- 701901-02 TRAFFIC CONTROL DEVICES
- 704001-07 TEMPORARY CONCRETE BARRIER

DISTRICT 1 DETAILS:

- TC08 ENTRANCE AND EXT RAMP CLOSURE DETAILS
- TC10 TRAFFIC CONTROL AND PROTECTION FOR SIDE ROADS, INTERSECTIONS AND DRIVEWAYS
- TC14 TRAFFIC CONTROL AND PROTECTION AT TURN BAYS (TO REMAIN OPEN TO TRAFFIC)
- TC16 PAVEMENT MARKING LETTERS AND SYMBOLS FOR TRAFFIC STAGING
- TC17 TRAFFIC CONTROL FOR SHOULDER CLOSURES AND PARTIAL RAMP CLOSURES
- TC21 DETOUR SIGNING FOR CLOSING STATE HIGHWAYS
- TC22 ARTERIAL ROAD INFORMATION SIGN
- TC26 DRIVEWAY ENTRANCE SIGNING

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DISTRICT 1 SPECIAL PROVISIONS:

MAINTENANCE OF ROADWAYS
KEEPING THE EXPRESSWAYS OPEN TO TRAFFIC (D-1)
TRAFFIC CONTROL PLAN (D-1)
TRAFFIC CONTROL AND PROTECTION (ARTERIALS) (D-1)
TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS) (D-1)
TRAFFIC CONTROL FOR WORK ZONE AREAS (D-1)
TEMPORARY INFORMATION SIGNING (D-1)
TYPE III TEMPORARY TAPE FOR WET CONDITIONS (D-1)
TEMPORARY PAVEMENT
AGGREGATE SURFACE COURSE FOR TEMPORARY ACCESS (D-1)

CONTRACT SPECIAL PROVISIONS:

KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC
CLEANING OF TRAFFIC CONTROL DEVICES
EXTENDED TRAFFIC CONTROL AND PROTECTION

SUPPLEMENTAL SPECIFICATIONS

IMPACT ATTENUATORS, TEMPORARY

BDE SPECIAL PROVISIONS

PAVEMENT MARKING REMOVAL
TRAFFIC CONTROL DEFICIENCY DEDUCTION
WET REFLECTIVE THERMOPLASTIC PAVEMENT MARKING

TRAFFIC CONTROL AND PROTECTION (ARTERIALS) (D-1)

Effective: February 1, 1996

Revised: March 1, 2011

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

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

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

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

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

TRAFFIC CONTROL AND PROTECTION (EXPRESSWAYS) (D-1)

Effective: 3/8/96

Revised: 4/20/10

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

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STATUS OF UTILITIES TO BE ADJUSTED (D-1)

Effective: January 30, 1987

Revised: July 1, 1994

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

NAME & ADDRESS OF UTILITY	TYPE	LOCATION / DESCRIPTION	ESTIMATED DURATION FROM AWARD TO COMPLETE RELOCATION
AT&T Legal Mandate Team 1000 Commerce Drive Oak Brook, IL 60523	UNDERGROUND TELEPHONE	EXISTING AT&T CONDUIT IN CONFLICT WITH PROPOSED ROADWAY CROSS SECTION, TRANSVERSE CROSSING AT STA. 61+00.	
	UNDERGROUND TELEPHONE	EXISTING AT&T CONDUIT IN CONFLICT WITH PROPOSED STORM SEWER AT LAWRENCE STA. 10+90.	
	UNDERGROUND TELEPHONE	EXISTING AT&T CONDUIT IN POTENTIAL CONFLICT WITH ROADWAY CROSS SECTION	NO CONFLICT ANTICIPATED. WATCH AND PROTECT.
ComEd Two Lincoln Center, 8th Floor Oakbrook Terrace, IL 60181	UNDERGROUND ELECTRIC	EXISTING COMED CONDUIT IN CONFLICT WITH PROPOSED ROADWAY CROSS SECTION, TRANSVERSE CROSSING AT STA. 61+68	
	UNDERGROUND ELECTRIC	EXISTING COMED CONDUIT IN CONFLICT WITH PROPOSED ROADWAY CROSS SECTION, TRANSVERSE CROSSING AT STA. 83+64	NO CONFLICT ANTICIPATED. WATCH AND PROTECT.

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FAA	MANHOLE	EXISTING FAA MANHOLE IN CONFLICT WITH PROPOSED MANNHEIM LEFT DITCH	PLANS SUBMITTED TO FAA TO RELOCATE FOTS LOOP 3
	UNDERGROUND FIBER OPTIC	EXISTING FAA DUCT LINE IN CONFLICT WITH PROPOSED SOUTHBOUND BALMORAL RAMP, BALMORAL UNDERPASS AND MANNHEIM LEFT DITCH.	PLANS SUBMITTED TO FAA TO RELOCATE FOTS LOOP 3
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH BALMORAL UNDERPASS AND BALMORAL RAMP, WEST SIDE OF MANNHEIM ROAD	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH BALMORAL UNDERPASS, EAST SIDE OF MANNHEIM ROAD	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH PROPOSED SEWER MANHOLE.	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH PROPOSED MANNHEIM LEFT DITCH.	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH PROPOSED STORM SEWER	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH BALMORAL STAGE III, WEST SIDE OF MANNHEIM ROAD	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH PROPOSED ROADWAY CROSS SECTION, TRANSVERSE CROSSING AT STA. 103+00	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH PROPOSED SEWER MANHOLE ALONG LAWRENCE AVENUE.	90 DAYS
	UNDERGROUND FIBER OPTIC	EXISTING MCI CONDUIT IN CONFLICT WITH PROPOSED SEWER MANHOLE ALONG LAWRENCE AVENUE.	90 DAYS
NICOR GAS Engineering Department 1844 Ferry Road Naperville, IL 60563	2" GAS	EXISTING 2" GAS LINE IN CONFLICT WITH PROPOSED ROADWAY CROSS SECTION ALONG LAWRENCE	60 DAYS
PEOPLES ENERGY 130 East Randolph Street Chicago, IL 60601	2" GAS	2" GAS, TRANSVERSE CROSSING AT STA. 103+40	30 DAYS

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

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

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

Revised 1/8/2013

ADJUSTMENTS AND RECONSTRUCTIONS

Effective: March 15, 2011

Revise the first paragraph of Article 602.04 to read:

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

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

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

Revise Article 603.05 to read:

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

Revise Article 603.06 to read:

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

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

Revise the first sentence of Article 603.07 to read:

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

AGGREGATE SUBGRADE IMPROVEMENT (D-1)

Effective: February 22, 2012

Revised: January 1, 2013

Add the following Section to the Standard Specifications:

“SECTION 303. AGGREGATE SUBGRADE IMPROVEMENT

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

303.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Coarse Aggregate	1004.06
(b) Reclaimed Asphalt Pavement (RAP) (Notes 1, 2)	1031

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

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

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

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

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

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

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

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

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

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

Revised 1/8/2013

Add the following to Section 1004 of the Standard Specifications:

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

- (a) Description. The coarse aggregate shall be crushed gravel, crushed stone, or crushed concrete.
- (b) Quality. The coarse aggregate shall consist of sound durable particles reasonably free of deleterious materials.
- (c) Gradation.
 - (1) The coarse aggregate gradation for total subgrade thickness less than or equal to 12 in. (300 mm) shall be CS 01.

The coarse aggregate gradation for total subgrade thickness more than 12 in. (300 mm) shall be CS 01 or CS 02.

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

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

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

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

Effective: November 1, 2011

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

Reclaimed Asphalt Pavement (RAP) maybe blended with gravel, crushed gravel, crushed stone crushed concrete, crushed slag, chats, crushed sand stone or wet bottom boiler slag. The RAP materials shall be crushed and screened. Unprocessed RAP grindings will not be permitted. The RAP shall be uniformly graded and shall pass the 1.0 in. (25 mm) screen. When RAP is blended with any of the coarse aggregate listed above, the blending shall be done mechanically with calibrated feeders. The feeders shall have an accuracy of ± 2.0 percent of the actual quantity of material delivered. The final blended product shall not contain more than 40 percent by weight RAP.

The coarse aggregate listed above shall meet CA 6 and CA 10 gradations prior to being blended with the processed and uniformly graded RAP.

Revised 1/8/2013

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

Effective: November 1, 2012

Revise: January 1, 2013

Revise Section 1031 of the Standard Specifications to read:

“SECTION 1031. RECLAIMED ASPHALT PAVEMENT AND RECLAIMED ASPHALT SHINGLES

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

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

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

- (a) RAP Stockpiles. The Contractor shall construct individual, sealed RAP stockpiles meeting one of the following definitions. 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. All stockpiles (including unprocessed RAP and Processed FRAP) shall be identified by signs indicating the type as listed below (i.e. “Non- Quality, FRAP -#4 or Type 2 RAS”, etc...).

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- (1) Fractionated RAP (FRAP). FRAP shall consist of RAP from Class I, Superpave HMA (High and Low ESAL) or equivalent mixtures. The coarse aggregate in FRAP shall be crushed aggregate and may represent more than one aggregate type and/or quality but shall be at least C quality. All FRAP shall be processed prior to testing sized into fractions with the separation occurring on or between the #4 (4.75 mm) and 1/2 in. (12.5 mm) sieves. Agglomerations shall be minimized such that 100 percent of the RAP in the coarse fraction shall pass the maximum sieve size specified for the mix the RAP will be used in.
- (2) Restricted FRAP (B quality) stockpiles shall consist of RAP from Class I, Superpave (High ESAL), or HMA (High ESAL). If approved by the Engineer, the aggregate from a maximum 3.0 inch single combined pass of surface/binder milling will be classified as B quality. All millings from this application will be processed into FRAP as described previously.
- (3) Conglomerate. Conglomerate RAP stockpiles shall consist of RAP from Class I, Superpave HMA (High and Low ESAL) or equivalent mixtures. The coarse aggregate in this RAP shall be crushed aggregate and may represent more than one aggregate type and/or quality but shall be at least C quality. This RAP may have an inconsistent gradation and/or asphalt binder content prior to processing. All conglomerate RAP shall be processed (FRAP) prior to testing. Conglomerate RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (4) Conglomerate "D" Quality (DQ). Conglomerate DQ RAP stockpiles shall consist of RAP from from HMA shoulders, bituminous stabilized subbases or Superpave (Low ESAL)/HMA (Low ESAL) IL-19.0L binder mixture. The coarse aggregate in this RAP may be crushed or round but shall be at least D quality. This RAP may have an inconsistent gradation and/or asphalt binder content. Conglomerate DQ RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (5) Non-Quality. RAP stockpiles that do not meet the requirements of the stockpile categories listed above shall be classified as "Non-Quality".

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

- (b) RAS Stockpiles. The Contractor shall construct individual, sealed RAS stockpiles meeting one of the following definitions. No additional RAS shall be added to the pile after the pile has been sealed. Type 1 and Type 2 RAS shall be stockpiled separately and shall be sufficiently separated to prevent intermingling at the base. Each stockpile shall be signed indicating what type of RAS is present.

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However, a RAS source may submit a written request to the Department for approval to blend mechanically a specified ratio of type 1 RAS with type 2 RAS. The source will not be permitted to change the ratio of the blend without the Department prior written approval. The Engineer's written approval will be required, to mechanically blend RAS with any fine aggregate produced under the AGCS, up to an equal weight of RAS, to improve workability. The fine aggregate shall be "B Quality" or better from an approved Aggregate Gradation Control System source. The fine aggregate shall be one that is approved for use in the HMA mixture and accounted for in the mix design and during HMA production.

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

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

(a) RAP/FRAP Testing. When used in HMA, the RAP/FRAP shall be sampled and tested either during processing or after stockpiling.

(1) During Stockpiling. For testing during stockpiling, washed extraction samples shall be run at the minimum frequency of one sample per 500 tons (450 metric tons) for the first 2000 tons (1800 metric tons) and one sample per 2000 tons (1800 metric tons) thereafter. A minimum of five tests shall be required for stockpiles less than 4000 tons (3600 metric tons).

(2) After Stockpiling. For testing after stockpiling, the Contractor shall submit a plan for approval to the District proposing a satisfactory method of sampling and testing the RAP/FRAP pile either in-situ or by restockpiling. The sampling plan shall meet the minimum frequency required above and detail the procedure used to obtain representative samples throughout the pile for testing.

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

(b) RAS Testing. RAS shall be sampled and tested either during or after stockpiling.

During stockpiling, washed extraction, and testing for unacceptable materials shall be run at the minimum frequency of one sample per 200 tons (180 metric tons) for the first 1000 tons (900 metric tons) and one sample per 1000 tons (900 metric tons) thereafter. A minimum of five samples are required for stockpiles less than 1000 tons (900 metric tons). Once a ≤ 1000 ton (900 metric ton), five-sample/test stockpile has been established it shall be sealed. Additional incoming RAS shall be stockpiled in a separate working pile as designated in the Quality Control plan and only added to the sealed stockpile when the test results of the working pile are complete and are found to meet the tolerances specified herein for the original sealed RAS stockpile.

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

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

- (a) Evaluation of RAP/FRAP Test Results. All of the extraction results shall be compiled and averaged for asphalt binder content and gradation and, when applicable (for slag) G_{mm} . Individual extraction test results, when compared to the averages, will be accepted if within the tolerances listed below.

Parameter	RAP or FRAP	Conglomerate "D" Quality RAP
1 in. (25 mm)		± 5 %
1/2 in. (12.5 mm)	± 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}	± 0.03 ^{2/}	

1/ The tolerance for FRAP shall be ± 0.3 %.

2/ For slag and steel slag

If more than 20 percent of the individual sieves and/or asphalt binder content tests are out of the above tolerances, the RAP/FRAP shall not be used in HMA unless the RAP/FRAP 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)".

- (b) Evaluation of RAS Test Results. All of the test results, with the exception of percent unacceptable materials, shall be compiled and averaged for asphalt binder content and gradation. Individual test results, when compared to the averages, will be accepted if within the tolerances listed below.

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Parameter	RAS
No. 8 (2.36 mm)	± 5 %
No. 16 (1.18 mm)	± 5 %
No. 30 (600 µm)	± 4 %
No. 200 (75 µm)	± 2.0 %
Asphalt Binder Content	± 1.5 %

If more than 20 percent of the individual sieves and/or asphalt binder content tests are out of the above tolerances, the RAS shall not be used in Department projects unless the RAS, RAP or FRAP representing the failing tests is removed from the stockpile. All test data and acceptance ranges shall be sent to the District for evaluation.

1031.05 Quality Designation of Aggregate in RAP/FRAP.

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

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

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

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

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

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

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

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

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

When the Contractor chooses the RAP option, the percentage of the percentage of virgin asphalt binder replaced by the asphalt binder from the RAP shall not exceed the percentages indicated in the table below for a given N Design:

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Max Asphalt Binder Replacement RAP Only

Table 1

HMA Mixtures ^{1/, 2/}	Maximum % Asphalt Binder replacement (ABR)			
	Ndesign	Binder/Leveling Binder	Surface	Polymer Modified
30L		25	15	10
50		25	15	10
70		15	10	10
90		10	10	10
105		10	10	10
4.75 mm N-50				15
SMA N-80				10

- 1/ For HMA "All Other" (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.
- 2/ When the asphalt binder replacement exceeds 15 percent, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement would require a virgin asphalt binder grade of PG64-22 to be reduced to a PG58-28). When constructing full depth HMA and the ABR is less than 15 percent, the required virgin asphalt binder grade shall be PG64-28.

When the Contractor chooses either the RAS or FRAP option, the percent binder replacement shall not exceed the amounts indicated in the tables below for a given N Design.

Max Asphalt Binder Replacement RAS or FRAP

Table 2

HMA Mixtures ^{1/, 2/}	Level 1 - Maximum % ABR			
	Ndesign	Binder/Leveling Binder	Surface	Polymer ^{3/, 4/} Modified
30L		35	30	15
50		30	25	15
70		30	20	15
90		20	15	15
105		20	15	15
4.75 mm N-50				25
SMA N-80				15

- 1/ For HMA "All Other" (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.

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2/ When the asphalt binder replacement exceeds 15 percent for all mixes, except for SMA and IL-4.75, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement will require a virgin asphalt binder grade of PG64-22 to be reduced to a PG58-28). When constructing full depth HMA and the ABR is less than 15 percent, the required virgin asphalt binder grade shall be PG64-28.

3/ When the ABR for SMA is 15 percent or less, the required virgin asphalt binder grade shall be SBS PG76-22.

4/ When the ABR for IL-4.75 mix is 15 percent or less, the required virgin asphalt binder grade shall be SBS PG76-22. When the ABR for the IL-4.75 mix exceeds 15 percent, the virgin asphalt binder grade shall be SBS PG70-28.

When the Contractor chooses the RAS with FRAP combination, the percent asphalt binder replacement shall split equally between the RAS and the FRAP, and the total replacement shall not exceed the amounts indicated in the tables below for a given N Design.

Max Asphalt Binder Replacement RAS and FRAP Combination
 Table 3

HMA Mixtures ^{1/, 2/}	Level 2 - Maximum % ABR		
Ndesign	Binder/Leveling Binder	Surface	Polymer Modified ^{3/, 4/}
30L	50	40	30
50	40	35	30
70	40	30	30
90	40	30	30
105	40	30	30
4.75 mm N-50			40
SMA N-80			30

1/ For HMA "All Other" (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.

2/ When the binder replacement exceeds 15 percent for all mixes, except for SMA and IL-4.75, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement will require a virgin asphalt binder grade of PG64-22 to be reduced to a PG58-28).

3/ When the ABR for SMA is 15 percent or less, the required virgin asphalt binder shall be SBS PG76-22. When the ABR for SMA exceeds 15%, the virgin asphalt binder grade shall be SBS PG70-28.

4/ When the ABR for IL-4.75 mix is 15 percent or less, the required virgin asphalt binder grade shall be SBS PG76-22. When the ABR for the IL-4.75 mix exceeds 15 percent, the virgin asphalt binder grade shall be SBS PG70-28.

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

All HMA mixtures will be required to be tested, prior to submittal for Department verification, according to Illinois Modified AASHTO T324 (Hamburg Wheel) and shall meet the following requirements:

Asphalt Binder Grade	# Repetitions	Max Rut Depth (mm)
PG76-XX	20,000	12.5
PG70-XX	20,000	12.5
PG64-XX	10,000	12.5
PG58-XX	10,000	12.5
PG52-XX	10,000	12.5
PG46-XX	10,000	12.5

Note: For SMA Designs (N-80) the maximum rut depth is 6.0 mm at 20,000 repetitions.
 For IL 4.75 mm Designs (N-50) the maximum rut depth is 9.0 mm at 15,000 repetitions.

1031.08 HMA Production. All HMA mixtures shall be sampled within the first 500 tons (450 metric tons) on the first day of production or during start up with a split reserved for the Department. The mix sample shall be tested according to the Illinois Modified AASHTO T 324 and shall meet the requirements specified herein. Mix production shall not exceed 1500 tons (1350 metric tons) or one day's production, whichever comes first, until the testing is completed and the mixture is found to be in conformance. The requirement to cease mix production may be waived if the plant produced mixture demonstrates conformance prior to start of mix production for a contract.

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

If the RAS, RAP and FRAP control tolerances or QC/QA test results require corrective action, the Contractor shall cease production of the mixture containing RAS, RAP or FRAP and either switch to the virgin aggregate design or submit a new RAS, RAP or FRAP design.

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

(1) Dryer Drum Plants.

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

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

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

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

- (a) Stockpiles and Testing. RAP stockpiles may be any of those listed in Article 1031.02, except "Non-Quality" and "FRAP". The testing requirements of Article 1031.03 shall not apply.
- (b) Gradation. One hundred percent of the RAP material shall pass the 1 1/2 in. (37.5mm) sieve. The RAP material shall be reasonably well graded from coarse to fine. RAP material that is gap-graded, FRAP, or single sized will not be accepted for use as Aggregate Surface Course and Aggregate Shoulders."

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DRAIN PIPE, TILE, DRAINAGE MAT, AND WALL DRAIN (BDE)

Effective: January 1, 2013

Add the following to Article 101.01 of the Standard Specifications.

“NTPEP National Transportation Product Evaluation Program”

Revise Article 1040.03(f) of the Standard Specifications to read:

“(f) Profile Wall Pipe-304. The manufacturer shall be listed as compliant through the NTPEP program and the pipe shall be according to AASHTO M 304.”

Revise the first sentence of the first paragraph of Article 1040.04(a) of the Standard Specifications to read:

“The manufacturer shall be listed as compliant through the NTPEP program and the pipe shall be according to AASHTO M 252 (nominal size – 3 to 10 in. (75 to 250 mm)).”

Revise Article 1040.04(b) of the Standard Specifications to read:

“(b) Corrugated PE Pipe with a Smooth Interior. The manufacturer shall be listed as compliant through the NTPEP program and the pipe shall be according to AASHTO M 294 (nominal size – 12 to 48 in. (300 to 1200 mm)). The pipe shall be Type S or D.”

FRICITION SURFACE AGGREGATE (D1)

Effective: January 1, 2011

Revised: November 1, 2012

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

“(4) Crushed Stone. Crushed stone shall be the angular fragments resulting from crushing undisturbed, consolidated deposits of rock by mechanical means. Crushed stone shall be divided into the following, when specified.

a. Carbonate Crushed Stone. Carbonate crushed stone shall be either dolomite or limestone. Dolomite shall contain 11.0 percent or more magnesium oxide (MgO). Limestone shall contain less than 11.0 percent magnesium oxide (MgO).

b. Crystalline Crushed Stone. Crystalline crushed stone shall be either metamorphic or igneous stone, including but is not limited to, quartzite, granite, rhyolite and diabase.”

Revised 1/8/2013

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

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

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

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

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HMA High ESAL Low ESAL	C Surface IL-12.5,IL-9.5, or IL-9.5L	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/} Crushed Concrete	
HMA High ESAL	D Surface IL-12.5 or IL-9.5	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone (other than Limestone) Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/} Crushed Concrete	
		<u>Other Combinations Allowed:</u>	
		<i>Up to...</i>	<i>With...</i>
		25% Limestone	Dolomite
		50% Limestone	Any Mixture D aggregate other than Dolomite
75% Limestone	Crushed Slag (ACBF) ^{1/} or Crushed Sandstone		

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HMA High ESAL	F Surface IL-12.5 or IL-9.5	<u>Allowed Alone or in Combination:</u>	
		Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{1/} Crushed Steel Slag ^{1/}	
		No Limestone or no Crushed Gravel alone.	
		<u>Other Combinations Allowed:</u>	
		<i>Up to...</i>	<i>With...</i>
		50% Crushed Gravel, or Dolomite	Crushed Sandstone, Crushed Slag (ACBF) ^{1/} , Crushed Steel Slag ^{1/} , or Crystalline Crushed Stone
HMA High ESAL	SMA Ndesign 80 Surface	Crystalline Crushed Stone Crushed Sandstone Crushed Steel Slag ^{1/}	

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

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GRANULAR MATERIALS (BDE)

Effective: November 1, 2012

Revise the title of Article 1003.04 of the Standard Specifications to read:

“1003.04 Fine Aggregate for Bedding, Trench Backfill, Embankment, Porous Granular Backfill, Sand Backfill for Underdrains, and French Drains.”

Revise Article 1003.04(c) of the Standard Specifications to read:

“(c) Gradation. The fine aggregate gradations for granular embankment, granular backfill, bedding, and trench backfill for pipe culverts and storm sewers shall be FA 1, FA 2, or FA 6 through FA 21.

The fine aggregate gradation for porous granular embankment, porous granular backfill, french drains, and sand backfill for underdrains shall be FA 1, FA 2, or FA 20, except the percent passing the No. 200 (75 µm) sieve shall be 2±2.”

Revise Article 1004.05(c) of the Standard Specifications to read:

“(c) Gradation. The coarse aggregate gradations shall be as follows.

Application	Gradation
Blotter	CA 15
Granular Embankment, Granular Backfill, Bedding, and Trench Backfill for Pipe Culverts and Storm Sewers	CA 6, CA 9, CA 10, CA 12, CA17, CA18, and CA 19
Porous Granular Embankment, Porous Granular Backfill, and French Drains	CA 7, CA 8, CA 11, CA 15, CA 16 and CA 18”

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REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES

Revise Article 669.01 of the Standard Specifications to read:

“669.01 Description. This work shall consist of the transportation and proper disposal of contaminated soil and water. This work shall also consist of the removal, transportation, and proper disposal of underground storage tanks (UST), their content and associated underground piping to the point where the piping is above the ground, including determining the content types and estimated quantities.”

Revise Article 669.08 of the Standard Specifications to read:

“669.08 Contaminated Soil and/or Groundwater Monitoring. The Contractor shall hire a qualified environmental firm to monitor the area containing the regulated substances. The affected area shall be monitored with a photoionization detector (PID) utilizing a lamp of 10.6eV or greater or a flame ionization detector (FID). Any field screen reading on the PID or FID in excess of background levels indicates the potential presence of contaminated material requiring handling as a non-special waste, special waste, or hazardous waste. No excavated soils can be taken to a clean construction and demolition debris (CCDD) facility or an uncontaminated soil fill operation with detectable PID or FID meter readings. The PID or FID meter shall be calibrated on-site and background level readings taken and recorded daily. All testing shall be done by a qualified engineer/technician. Such testing and monitoring shall be included in the work. The Contractor shall identify the exact limits of removal of non-special waste, special waste, or hazardous waste. All limits shall be approved by the Engineer prior to excavation. The Contractor shall take all necessary precautions.

Based upon PID or FID readings indicating contamination, a soil or groundwater sample shall be taken from the same location and submitted to an approved laboratory. Soil or groundwater samples shall be analyzed for the contaminants of concern, including pH, based on the property's land use history or the parameters listed in the maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605. The analytical results shall serve to document the level of soil contamination. Soil and groundwater samples may be required at the discretion of the Engineer to verify the level of soil and groundwater contamination.

Samples shall be grab samples (not combined with other locations). The samples shall be taken with disposable instruments. The samples shall be placed in sealed containers and transported in an insulated container to the laboratory. The container shall maintain a temperature of 39 °F (4 °C). All samples shall be clearly labeled. The labels shall indicate the sample number, date sampled, location and elevation, and any other observations.

The laboratory shall use a detectable concentration which is equal to the lowest appropriate practical quantitation limits (PQL) or estimated quantitation limit (EQL) specified in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water", EPA, EMSL, EPA-600/4-88/039. For parameters where the specified cleanup objective is below the acceptable detection limit (ADL), the ADL shall serve as the cleanup objective. For other parameters the ADL shall be equal to or below the specified cleanup objective.”

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Replace the first two paragraphs of Article 669.09 of the Standard Specifications with the following:

“669.09 Contaminated Soil and/or Groundwater Management and Disposal. The management and disposal of contaminated soil and/or groundwater shall be according to the following:

- (a) Soil Analytical Results Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels exceed the most stringent maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605, the soil shall be managed as follows:
 - (1) When analytical results indicate inorganic chemical constituents exceed the most stringent MAC but they are still considered within area background levels by the Engineer, the excavated soil can be utilized within the construction limits as fill, when suitable. Such soil excavated for storm sewers can be placed back into the excavated trench as backfill, when suitable, unless trench backfill is specified. If the soils cannot be utilized within the construction limits, they shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.
 - (2) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for a Metropolitan Statistical Area (MSA) County, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (3) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, or the MAC within the Chicago corporate limits, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County excluding Chicago or within the Chicago corporate limits provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (4) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an uncontaminated soil fill operation within an MSA County excluding Chicago provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (5) When the Engineer determines soil cannot be managed according to Articles 669.09(a)(1) through (a)(4) above, the soil shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.

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- (b) Soil Analytical Results Do Not Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels do not exceed the most stringent MAC but the pH of the soil is less than 6.25 or greater than 9.0, the excavated soil can be utilized within the construction limits or managed and disposed of off-site as “uncontaminated soil” according to Article 202.03. However the excavated soil cannot be taken to a CCDD facility or an uncontaminated soil fill operation.
- (c) Groundwater. When groundwater analytical results indicate the detected levels are above Appendix B, Table E of 35 Illinois Administrative Code 742, the most stringent Tier 1 Groundwater Remediation Objectives for Groundwater Component of the Groundwater Ingestion Route for Class 1 groundwater, the groundwater shall be managed off-site as a special waste.

All groundwater encountered within lateral trenches may be managed within the trench and allowed to infiltrate back into the ground. If the groundwater cannot be managed within the trench it must be removed as a special or hazardous waste. The Contractor is prohibited from managing groundwater within the trench by discharging it through any existing or new storm sewer. The Contractor shall install backfill plugs within the area of groundwater contamination.

One backfill plug shall be placed down gradient to the area of groundwater contamination. Backfill plugs shall be installed at intervals not to exceed 50 ft (15 m). Backfill plugs are to be 4 ft (1.2 m) long, measured parallel to the trench, full trench width and depth. Backfill plugs shall not have any fine aggregate bedding or backfill, but shall be entirely cohesive soil or any class of concrete. The Contractor shall provide test data that the material has a permeability of less than 10^{-7} cm/sec according to ASTM D 5084, Method A or per another test method approved by the Engineer.”

Revise Article 669.14 of the Standard Specifications to read:

“669.14 Final Environmental Construction Report. At the end of the project, the Contractor will prepare and submit three copies of the Environmental Construction Report on the activities conducted during the life of the project, one copy shall be submitted to the Resident Engineer, one copy shall be submitted to the District's Environmental Studies Unit, and one copy shall be submitted with an electronic copy in Adode.pdf format to the Geologic and Waste Assessment Unit, Bureau of Design and Environment, IDOT, 2300 South Dirksen Parkway, Springfield, Illinois 62764. The technical report shall include all pertinent information regarding the project including, but not limited to:

- (a) Measures taken to identify, monitor, handle, and dispose of soil or groundwater containing regulated substances, to prevent further migration of regulated substances, and to protect workers,
- (b) Cost of identifying, monitoring, handling, and disposing of soil or groundwater containing regulated substances, the cost of preventing further migration of regulated substances, and the cost for worker protection from the regulated substances. All cost should be in the format of the contract pay items listed in the contract plans (identified by the preliminary environmental site investigation (PESA) site number),

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- (c) Plan sheets showing the areas containing the regulated substances,
- (d) Field sampling and testing results used to identify the nature and extent of the regulated substances,
- (e) Waste manifests (identified by the preliminary environmental site investigation (PESA) site number) for special or hazardous waste disposal, and
- (f) Landfill tickets (identified by the preliminary environmental site investigation (PESA) site number) for non-special waste disposal.”

Revise the second paragraph of Article 669.16 of the Standard Specifications to read:

“The transportation and disposal of soil and other materials from an excavation determined to be contaminated will be paid for at the contract unit price per cubic yard (cubic meter) for NON-SPECIAL WASTE DISPOSAL, SPECIAL WASTE DISPOSAL, or HAZARDOUS WASTE DISPOSAL.”

Qualifications. The term environmental firm shall mean an environmental firm with at least five (5) documented leaking underground storage tank (LUST) cleanups or that is pre-qualified in hazardous waste by the Department. Documentation includes but not limited to verifying remediation and special waste operations for sites contaminated with gasoline, diesel, or waste oil in accordance with all Federal, State, or local regulatory requirements and shall be provided to the Engineer for approval. The environmental firm selected shall not be a former or current consultant or have any ties with any of the properties contained within and/or adjacent to this construction project.

General. This Special Provision will likely require the Contractor to subcontract for the execution of certain activities.

All contaminated materials shall be managed as either “uncontaminated soil” or non-special waste. This work shall include monitoring and potential sampling, analytical testing, and management of a material contaminated by regulated substances. The Environmental Firm shall continuously monitor all soil excavation for worker protection and soil contamination.

Phase I Preliminary Engineering information is available through the District’s Environmental Studies Unit. Soil samples or analysis without the approval of the Engineer will be at no additional cost to the Department. The lateral distance is measured from centerline and the farthest distance is the offset distance or construction limit whichever is less.

The Contractor shall manage any excavated soils and sediment within the following areas:

- Station 28+00 to Station 30+80 0 to 100 feet LT (British Airways World Cargo/JAL Japan Airlines/EVA Air, PESA Site 1102V2-97, Building 516 O’Hare International Airport). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs and Lead.

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- Station 28+00 to Station 31+20 0 to 100 feet RT (Wooded Land, PESA Site 1102V2-74). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs, Iron, and Manganese.
- Station 35+00 to Station 37+30 0 to 100 feet LT (USPS Chicago International/Military Service Center, PESA Site 1102V2-96, Building 514 O'Hare International Airport). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 43+70 to Station 50+30 0 to 100 feet RT (Wooded Land, PESA Site 1102V2-74). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 49+70 to Station 50+50 0 to 100 feet LT (Snow Dump, PESA Site 1102V2-94). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 50+50 to Station 51+50 0 to 100 feet LT (AOR Trailer Complex, PESA Site 1102V2-93). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 54+00 to Station 57+50 0 to 100 feet LT (AOR Trailer Complex, PESA Site 1102V2-93). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs and Lead.
- Station 61+20 to Station 68+00 0 to 100 feet RT (O'Hare Aerospace Center, PESA Site 1102V2-71, 9950 West Lawrence Avenue and 4825 and 4849 North Scott Street). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs and Arsenic.
- Station 74+00 to Station 76+70 0 to 120 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs and Lead.
- Station 83+30 to Station 87+00 0 to 100 feet RT (Vacant Land and Navigation Aids, PESA Site 1102V2-68). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 85+00 to Station 87+50 0 to 100 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.

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- Station 87+50 to Station 94+50 0 to 100 feet LT (Cargo Building, PESA Site 1102V2-89, Building 510 O'Hare International Airport). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 104+70 to Station 107+80 0 to 170 feet RT (State ROW, PESA Site 1102V2-64). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 11+00 to Station 15+30 (Lawrence Avenue) 0 to 70 feet LT (O'Hare Aerospace Center, PESA Site 1102V2-71, 9950 West Lawrence Avenue and 4825 and 4849 North Scott Street). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs and Arsenic.
- Station 11+50 to Station 15+30 (Lawrence Avenue) 0 to 100 feet RT (Vacant Land, PESA Site 1102V2-72). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs, Lead, and Manganese.
- Station 23+00 to Station 32+20 (Southbound Mannheim Road Exit Ramp) 0 to 250 feet RT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs and Iron.
- Station 33+60 to Station 36+40 (Southbound Mannheim Road Exit Ramp) 0 to 250 feet RT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 23+00 to Station 26+00 (Southbound Mannheim Road Exit Ramp) 0 to 100 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 28+00 to Station 29+70 (Southbound Mannheim Road Exit Ramp) 0 to 200 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(a)(5) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs.
- Station 34+30 to Station 38+30 0 to 100 feet RT (Wooded Land, PESA Site 1102V2-74). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Arsenic and Manganese.

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- Station 43+20 to Station 44+60 0 to 300 feet LT (Storage Yard, PESA Site 1102V2-95, 506 Express Center Drive). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Arsenic.
- Station 67+60 to Station 70+50 0 to 100 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Arsenic.
- Station 77+40 to Station 79+50 0 to 80 feet RT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Arsenic.
- Station 79+50 to Station 81+00 0 to 120 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(a)(1) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Manganese.
- Station 44+60 to Station 47+00 0 to 300 feet LT (Snow Dump, PESA Site 1102V2-94). This material meets the criteria of Article 669.09(a)(3) and shall be managed in accordance to Article 669.09.
- Station 92+00 to Station 94+50 0 to 100 feet RT (Vacant Land and Navigation Aids, PESA Site 1102V2-68). This material meets the criteria of Article 669.09(a)(3) and shall be managed in accordance to Article 669.09.
- Station 32+20 to Station 33+60 0 to 100 feet RT (Vacant Land and Navigation Aids, PESA Site 1102V2-68). This material meets the criteria of Article 669.09(a)(3) and shall be managed in accordance to Article 669.09.
- Station 30+80 to Station 32+50 0 to 100 feet LT (Crystal Creek, PESA Site 1102V2-75). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 32+20 to Station 34+30 0 to 100 feet RT (Crystal Creek, PESA Site 1102V2-75). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 38+30 to Station 43+70 0 to 100 feet RT (Wooded Land, PESA Site 1102V2-74). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 40+50 to Station 43+20 0 to 100 feet LT (Storage Yard, PESA Site 1102V2-95, 506 Express Center Drive). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.

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- Station 47+00 to Station 49+70 0 to 100 feet LT (Snow Dump, PESA Site 1102V2-94). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 51+50 to Station 54+00 0 to 100 feet LT (AOR Trailer Complex, PESA Site 1102V2-93). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 50+30 to Station 61+20 0 to 100 feet RT (Vacant Land, PESA Site 1102V2-72). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 57+50 to Station 63+50 0 to 100 feet LT (Salt Dome and Vacant Land, PESA Site 1102V2-92). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 65+60 to Station 67+60 0 to 100 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 68+00 to Station 72+50 0 to 100 feet RT (Vacant Lot and Navigation Aids, PESA Site 1102V2-70). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 76+70 to Station 79+50 0 to 120 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 87+00 to Station 92+0 0 to 100 feet RT (Vacant Land and Navigation Aids, PESA Site 1102V2-68). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 94+50 to Station 99+00 0 to 100 feet LT (Evergreen Eagle, PESA Site 1102V2-88, Building 511 O'Hare International Airport). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 99+00 to Station 104+70 0 to 100 feet LT (Vacant Lot and Employee Parking Lot, PESA Site 1102V2-87). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 94+50 to Station 102+00 0 to 100 feet RT (Vacant Land and Navigation Aids, PESA Site 1102V2-68). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 104+70 to Station 114+80 0 to 100 feet LT (State ROW, PESA Site 1102V2-64). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.

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- Station 107+80 to Station 114+80 0 to 200 feet RT (State ROW, PESA Site 1102V2-64). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 21+00 to Station 23+00 0 to 150 feet RT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 21+00 to Station 23+00 0 to 250 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 26+00 to Station 28+00 0 to 100 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 29+70 to Station 33+00 0 to 200 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 26+00 to Station 28+00 100 to 200 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 28+00 to Station 29+70 200 to 300 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(b) and shall be managed in accordance to Article 669.09.
- Station 14+00 to Station 21+00 0 to 100 feet LT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). This material meets the criteria of Article 669.09(c) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: Iron, Lead, and Manganese.
- Station 21+00 to Station 33+00 (Southbound Mannheim Road Exit Ramp) 0 to 230 feet RT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(c) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs, Iron, Lead, Manganese, Vanadium.
- Station 21+00 to Station 33+00 (Southbound Mannheim Road Exit Ramp) 0 to 400 feet LT (Vacant Land, PESA Site 1102V2-69). This material meets the criteria of Article 669.09(c) and shall be managed in accordance to Article 669.09. Contaminants of concern sampling parameters: PNAs, Iron, Lead, Manganese, Vanadium.

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Backfill pugs shall be place within the following locations.

- Station 50+20 to Station 50+70 0 to 100 feet LT (AOR Trailer Complex, PESA Site 1102V2-93). Contaminants of concern sampling parameters: PNAs and Iron.
- Station 14+00 to Station 21+00 (Southbound Mannheim Road Exit Ramp) 0 to 100 feet RT (Navigation Aids, PESA Site 1102V2-90, Building 992 O'Hare International Airport). Contaminants of concern sampling parameters: Iron, Lead, and Manganese.
- Station 21+00 to Station 31+00 (Southbound Mannheim Road Exit Ramp) 0 to 230 feet RT (Vacant Land, PESA Site 1102V2-69). Contaminants of concern sampling parameters: PNAs, Iron, Lead, Manganese, Vanadium.

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STORM WATER POLLUTION PREVENTION PLAN



Storm Water Pollution Prevention Plan

Route	<u>Mannheim Road</u>	Marked Rte.	<u>F.A.P. 330 (US12/45)</u>
Section	<u>0105-WRS-1</u>	Project No.	<u>P-11-103</u>
County	<u>Cook</u>	Contract No.	<u>60G37</u>

This plan has been prepared to comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) Permit No. ILR10 (Permit ILR10), issued by the Illinois Environmental Protection Agency (IEPA) for storm water discharges from construction site activities.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John Fortmann, P.E.
 Print Name
Acting Deputy Director of Highways, Region 1 Engineer
 Title
Illinois Department of Transportation
 Agency

John Fortmann
 Signature
JUNE 11, 2012
 Date

I. Site Description:

A. Provide a description of the project location (include latitude and longitude):

Mannheim Road from the intersection of Irving Park Rd. north to the south abutment of the Mannheim Road Bridge over I-190. Approximate Latitude / Longitude = N 41 deg 58' 6.2" / W 87 deg 52' 35.4", a distance of approximately 1.6 miles.

B. Provide a description of the construction activity which is the subject of this plan:

The project consists of the reconstruction and widening of Mannheim Road from two to three lanes north and south bound from Irving Park Road to I-190 and improvements to the interchange with Balmoral Avenue that involve new ramps, retaining walls and an underpass below Mannheim Road. The intended sequence of major activities which will disturb soils for major portions of the construction site is described below.

Pre-Stage

- Install Erosion and Sediment Control measures for the Pre-Stage work areas.
- Reconstruct and widen the outside and inside shoulders of the southbound Mannheim Road between the project limits.
- Construct temporary mainline crossovers for shifting the northbound traffic to the southbound lanes and construct temporary ramp crossovers for northbound traffic to access I-190.
- Construct temporary ditches, swales, pipe culverts and storm sewers as required to maintain drainage, including the proposed storm sewer that drains to Crystal Creek. This storm sewer is sized for stormwater detention and includes a restrictor manhole to control the discharge rate to Crystal Creek.

Stage 1

- Install Erosion and Sediment Control measures for the Stage 1 work areas.
- Construct the northbound Mannheim Road mainline pavement and inside and outside shoulders.
- Remove and replace storm sewer along Mannheim Road from Lawrence Avenue to a connection to an existing 48-inch storm sewer near I-190. This 48 inch storm sewer flows to the east and combines with

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other storm sewers that discharge to Pump Station #24, which pumps stormwater to the west bank of the DesPlaines River.

- Construct Mannheim Road in the Vicinity of I-190 in sub-stages as indicated on the Maintenance of Traffic Plans.

Stage 2

- Install Erosion and Sediment Control measures for the Stage 2 work areas.
- Construct the southbound Mannheim Road mainline pavement and inside and outside shoulders.

Stage 3

- Install Erosion and Sediment Control measures for the Stage 3 work areas.
- Construct the median barrier wall and base along with the curb and gutter along the raised median.
- Remove temporary Erosion and Sediment Control measures.
- Complete permanent seeding and other permanent stabilization measures.

Intersections

The reconstruction of the Lawrence Avenue Intersection and the Balmoral Avenue Underpass will be done in multiple sub-stages throughout Stages 1 and 2. Both intersections include the construction of storm sewers for local drainage. The Balmoral Avenue Underpass also includes retaining walls, a stormwater pump station, and a stormwater detention basin.

Additional description of the work to be completed in each stage is provided in the Maintenance of Traffic – General Notes, Suggested Staging and Plan Sheets.

- C. Provide the estimated duration of this project:

Approximately 14 months.

- D. The total area of the construction site is estimated to be 48 acres.

The total area of the site estimated to be disturbed by excavation, grading or other activities is 43 acres.

- E. The following is a weighted average of the runoff coefficient for this project after construction activities are completed:

$C = 0.77$

The following is a weighted average of the runoff coefficient for this project before construction activities are completed:

$C = 0.72$

- F. List all soils found within project boundaries. Include map unit name, slope information, and erosivity:

Soil maps as prepared by the United States Department of Agriculture Natural Resources Conservation Service indicate that the project is in an unmapped area (UA). The Geotechnical Investigation completed for the project indicates that the surficial soils within the project corridor consist of Wadsworth Till Member soils of the Wedron Formation. The Wadsworth soils generally consist of clayey and silty clay tills. Localized areas were identified where higher moisture content soils were present at the proposed subgrade elevation and removal and replacement of these soils was recommended to provide suitable support of the new pavement.

- G. Provide an aerial extent of wetland acreage at the site:

Any wetlands that previously existed within the South Mannheim Road project limits have been mitigated in accordance with Army Corps Section 404 Permit Authorization Number 200301000 and are no longer under the jurisdiction of the USACE.

- H. Provide a description of potentially erosive areas associated with this project:

Potentially erosive areas for the Mannheim Road South Reconstruction Project include: the vicinity immediately

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around Crystal Creek; the embankment slopes adjacent to the new ramps for the Balmoral Avenue Underpass; and the embankment slopes, south of the Mannheim Road Bridge over I-190.

- I. The following is a description of soil disturbing activities by stages, their locations, and their erosive factors (e.g. steepness of slopes, length of slopes, etc):

A description of soil disturbing activities by stages is included in Item I.B.

- J. See the erosion control plans and/or drainage plans for this contract for information regarding drainage patterns, approximate slopes anticipated before and after major grading activities, locations where vehicles enter or exit the site and controls to prevent offsite sediment tracking (to be added after contractor identifies locations), areas of soil disturbance, the location of major structural and non-structural controls identified in the plan, the location of areas where stabilization practices are expected to occur, surface waters (including wetlands) and locations where storm water is discharged to surface water including wetlands.

- K. Identify who owns the drainage system (municipality or agency) this project will drain into:

The existing and proposed drainage system is located entirely within the Right-of-Way owned by The Illinois Department of Transportation

- L. The following is a list of receiving water(s) and the ultimate receiving water(s) for this site. The location of the receiving waters can be found on the erosion and sediment control plans:

Receiving Water	Ultimate Receiving Water
Crystal Creek	Des Plaines River
Des Plaines River	Illinois River

The storm sewer system, Crystal Creek, Willow Higgins Creek and the Des Plaines River are not listed as "biologically significant streams."

- M. Describe areas of the site that are to be protected or remain undisturbed. These areas may include steep slopes, highly erodible soils, streams, stream buffers, specimen trees, natural vegetation, nature preserves, etc.

All locations within the construction limits are expected to be disturbed through construction site activities and should be protected. The projects ends at the south abutment of the Mannheim Road Bridge over I-190. The existing construction area primarily consists of existing roadway with a gravel median within IDOT Right-of-Way. Embankments associated with the Balmoral Avenue Underpass and on the NB and SB sides of Mannheim Road towards the northern contract limits include steep slopes. The Crystal Creek Floodway passes through the southern limits of the project. The culvert that conveys the creek under Mannheim Road is not being modified but the creek is an outfall for discharges from the project. Procedures to minimize damages to these areas are described in the Controls section of the SWPPP.

- N. The following sensitive environmental resources are associated with this project, and may have the potential to be impacted by the proposed development:

- Floodplain
- Wetland Riparian
- Threatened and Endangered Species
- Historic Preservation
- 303(d) Listed receiving waters for suspended solids, turbidity, or siltation
- Receiving waters with Total Maximum Daily Load (TMDL) for sediment, total suspended solids, turbidity or siltation
- Applicable Federal, Tribal, State or Local Programs
- Other

1. 303(d) Listed receiving waters (fill out this section if checked above):

- a. The name(s) of the listed water body, and identification of all pollutants causing impairment:

The Des Plaines River, Segment ID IL_G-15 is included on the Illinois 2010 303(d) List. Pollutants causing impairment of Aquatic Life include Chloride, Sedimentation/Siltation, and Phosphorus(Total); pollutants causing impairment of Fish Consumption include Mercury and Polychlorinated biphenyls; and pollutants causing impairment of Primary Contact Recreation include Fecal Coliform.

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- b. Provide a description of how erosion and sediment control practices will prevent a discharge of sediment resulting from a storm event equal to or greater than a twenty-five (25) year, twenty-four (24) hour rainfall event:
- The erosion and sediment control practices as described in the following section and as shown on the Erosion and Sediment Control Drawings will be installed and maintained by the Contractor. These practices will also be observed by the Resident Engineer and if necessary, instruction will be given to the Contractor to provide additional erosion and sediment control practices.
- The potential that construction activities performed onsite will impact the impaired Crystal Creek and Des Plaines River is reduced by the construction BMPs (on-site detention basin, temporary erosion control seeding, compost, temporary ditch checks, perimeter erosion barrier, and inlet filters) in this plan. It is unlikely for there to be quantities of soluble phosphorus, fluoride, mercury, zinc, or PCBs discharged. Portable toilets will be placed away from inlets and water courses. Chloride will discharge, especially during winter application of ice melters required for safety.
- c. Provide a description of the location(s) of direct discharge from the project site to the 303(d) water body:
- The northern portion of the project from Lawrence Avenue to I-190 drains into a 48 inch storm sewer that is tributary along with other storm sewers to Stormwater Pump Station 24, which discharges to the west bank of the Des Plaines River just south of I-190.
- d. Provide a description of the location(s) of any dewatering discharges to the MS4 and/or water body:
- The design and implementation of dewatering systems as needed to construct facilities included in this contract are the responsibility of the Contractor. At the start of construction the Contractor will be required to submit a dewatering plan which includes a description and location of dewatering discharges.
2. TMDL (fill out this section if checked above)
- a. The name(s) of the listed water body:
- b. Provide a description of the erosion and sediment control strategy that will be incorporated into the site design that is consistent with the assumptions and requirements of the TMDL:
- c. If a specific numeric waste load allocation has been established that would apply to the project's discharges, provide a description of the necessary steps to meet that allocation:

O. The following pollutants of concern will be associated with this construction project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Soil Sediment | <input checked="" type="checkbox"/> Petroleum (gas, diesel, oil, kerosene, hydraulic oil / fluids) |
| <input checked="" type="checkbox"/> Concrete | <input checked="" type="checkbox"/> Antifreeze / Coolants |
| <input checked="" type="checkbox"/> Concrete Truck Waste | <input checked="" type="checkbox"/> Waste water from cleaning construction equipment |
| <input checked="" type="checkbox"/> Concrete Curing Compounds | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Solid Waste Debris | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Paints | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Solvents | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Fertilizers / Pesticides | <input type="checkbox"/> Other (specify) |

II. Controls:

This section of the plan addresses the controls that will be implemented for each of the major construction activities described in I.B. above and for all use areas, borrow sites, and waste sites. For each measure discussed, the Contractor will be responsible for its implementation as indicated. The Contractor shall provide to the Resident Engineer a plan for the implementation of the measures indicated. The Contractor, and subcontractors, will notify the Resident Engineer of any proposed changes, maintenance, or modifications to keep construction activities compliant with the Permit ILR10. Each such Contractor has signed the required certification on forms which are attached to, and are a part of, this plan:

A. Erosion and Sediment Controls

1. **Stabilized Practices:** Provided below is a description of interim and permanent stabilization practices, including site specific scheduling of the implementation of the practices. Site plans will ensure that existing vegetation is preserved where attainable and disturbed portions of the site will be stabilized. Stabilization practices may include but are not limited to: temporary seeding, permanent seeding, mulching, geotextiles, sodding, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other

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appropriate measures. Except as provided below in II(A)(1)(a) and II(A)(3), stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than seven (7) days after the construction activity in that portion of the site has temporarily or permanently ceases on all disturbed portions of the site where construction will not occur for a period of fourteen (14) or more calendar days.

Where the initiation of stabilization measures by the seventh day after construction activity temporarily or permanently ceases is precluded by snow cover, stabilization measures shall be initiated as soon as practicable thereafter.

The following stabilization practices will be used for this project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Preservation of Mature Vegetation | <input checked="" type="checkbox"/> Erosion Control Blanket / Mulching |
| <input type="checkbox"/> Vegetated Buffer Strips | <input type="checkbox"/> Sodding |
| <input checked="" type="checkbox"/> Protection of Trees | <input type="checkbox"/> Geotextiles |
| <input checked="" type="checkbox"/> Temporary Erosion Control Seeding | <input checked="" type="checkbox"/> Other (specify) Short Term Seeding |
| <input type="checkbox"/> Temporary Turf (Seeding, Class 7) | <input checked="" type="checkbox"/> Other (specify) Turf Reinforcement Matting |
| <input checked="" type="checkbox"/> Temporary Mulching | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Permanent Seeding | <input type="checkbox"/> Other (specify) |

Describe how the stabilization practices listed above will be utilized during construction:

1. Preservation of Mature Vegetation - Mature vegetation shall be protected by "temporary fencing" as directed by the engineer and in accordance with Article 201.05 of the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction.
2. Temporary Erosion Control Seeding shall be applied in accordance with the Special Provision. Seed mixture will depend on the time of year it is applied. Oats will be applied from January 1 to July 31 and Hard Red Winter Wheat from August 1 to December 31.
3. Short Term Seeding — Seeding Class 2A shall be used to protect bare earth from more than just one or two summer-winter cycles. Due to the length and complexity of this project, it is necessary that short term, final graded slopes be short term seeded as directed by the Engineer.
4. Protection of Trees — Shall consist of items "temporary fencing" and "tree trunk protection" as directed by the engineer and in accordance with Article 201.05 of the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction.
5. Permanent Seeding — All areas disturbed by construction will be stabilized as soon as permitted with permanent seeding following the finished grading, but always within seven days with Temporary Erosion Control Seeding. Erosion Blankets will be installed over fill slopes, which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and allow seeds to germinate properly.
5. Temporary Mulching - Mulch method 4 shall be used as temporary stabilization on the bridge embankments.
6. Erosion Control Blankets and Mulching — Erosion control blankets will be installed over fill slopes with slopes less than 3:1. Mulch will be applied in relatively flat areas to prevent erosion
7. Turf Reinforcement Matting (TRM) will be installed on slopes steeper than 3:1 and in ditches where flow velocities are greater than 7 feet per second.

Describe how the stabilization practices listed above will be utilized after construction activities have been completed:

At the completion of grading and application of final seeding, stabilization practices shall be removed.

2. **Structural Practices:** Provided below is a description of structural practices that will be implemented, to the degree attainable, to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Such practices may include but are not limited to: perimeter erosion barrier, earth dikes, drainage swales, sediment traps, ditch checks, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins. The installation of these devices may be subject to Section 404 of the Clean Water Act.

The following structural practices will be used for this project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Perimeter Erosion Barrier | <input checked="" type="checkbox"/> Rock Outlet Protection |
| <input checked="" type="checkbox"/> Temporary Ditch Check | <input checked="" type="checkbox"/> Riprap |

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- | | |
|---|---|
| <input checked="" type="checkbox"/> Storm Drain Inlet Protection | <input type="checkbox"/> Gabions |
| <input checked="" type="checkbox"/> Sediment Trap | <input type="checkbox"/> Slope Mattress |
| <input checked="" type="checkbox"/> Temporary Pipe Slope Drain | <input checked="" type="checkbox"/> Retaining Walls |
| <input checked="" type="checkbox"/> Temporary Sediment Basin | <input type="checkbox"/> Slope Walls |
| <input type="checkbox"/> Temporary Stream Crossing | <input type="checkbox"/> Concrete Revetment Mats |
| <input checked="" type="checkbox"/> Stabilized Construction Exits | <input type="checkbox"/> Level Spreaders |
| <input checked="" type="checkbox"/> Turf Reinforcement Mats | <input checked="" type="checkbox"/> Other (specify) Dewatering Basin |
| <input type="checkbox"/> Permanent Check Dams | <input checked="" type="checkbox"/> Other (specify) Dust Control |
| <input type="checkbox"/> Permanent Sediment Basin | <input checked="" type="checkbox"/> Other (specify) Stable Conveyance During Storm Sewer Installation |
| <input type="checkbox"/> Aggregate Ditch | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Paved Ditch | <input type="checkbox"/> Other (specify) |

Describe how the structural practices listed above will be utilized during construction:

1. Sediment Control, Stabilized Construction Exits – Coarse aggregate overlaying a geotextile fabric will be placed in locations necessary for contractor access. The aggregate surface of the access points will capture soil debris, reducing the amount of soil deposits placed on to the roadway by vehicles leaving the work zones.
2. Storm Drain Inlet Protection – Inlet filters will be placed in every inlet, catch basin or manhole with an open lid, which will drain water during at least a 10-year storm event. The Erosion Control Plan identifies the structures requiring Inlet filters.
3. Perimeter Erosion Barrier — A sediment control silt fence will be placed at the locations shown on the erosion control plans to intercept waterborne silt and prevent it from leaving the site.
4. Temporary Ditch Checks — Rolled excelsior ditch checks will be placed in swales at the rate of one for every 1 foot in vertical drop, or as directed by the Engineer, in order to prevent downstream erosion.
5. Sediment Control, Temporary Pipe Slope Drain – This item consists of a pipe with flared end sections, placed daily, along with anchor devices in conjunction with temporary berms that direct runoff down an unstabilized slope.
6. Sediment Trap / Sediment Basin - All surface runoff must pass through a sediment trap / sediment trap sediment basin prior to outletting into an receiving water. The maximum drainage area allowed per trap is 5 acres (including on-site and off-site tributary areas). If drainage area is over 5 acres, a sediment basin or several sediment traps in series may be used. The trap/basin should adequately be sized to store the runoff from either a 2-year storm frequency, 24-hour duration or 3,600 cubic feet
7. Sediment Control, Dewatering Basin - This item will be provided at wherever the contractor is removing and discharging water from excavated areas and the water is not being routed through a sediment trap or basin.
8. Stone Riprap - Class A4 stone riprap with filter fabric will be used as protection at the discharge end of storm sewer outfalls to prevent scouring and downstream erosion.
9. Covers will be placed on open ends of pipes in trenches.
10. Dust Control – Dust control measures will be performed for the duration of the construction.
11. Retaining Walls – Retaining walls will be used in the construction of the Balmoral Avenue Underpass.
12. Stable Conveyance During Storm Sewer Installation – Contractor is to provide a plan for conveyance of runoff during storm sewer demolition and construction. The plan will provide that runoff does not erode and convey sediment into storm sewer under construction. This plan may be by sequencing or stabilization

Describe how the structural practices listed above will be utilized after construction activities have been completed:

When final grading is completed and all storm water management systems are in place, structural practices shall be removed. At locations where riprap is to remain from the "interim" construction condition, the contractor shall investigate each site and repair/replace the riprap as directed by the engineer in the field.

3. **Storm Water Management:** Provided below is a description of measures that will be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed. The installation of these devices may be subject to Section 404 of the Clean Water Act.
 - a. Such practices may include but are not limited to: storm water detention structures (including wet ponds), storm water retention structures, flow attenuation by use of open vegetated swales and natural depressions, infiltration of runoff on site, and sequential systems (which combine several practices).

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The practices selected for implementation were determined on the basis of the technical guidance in Chapter 41 (Construction Site Storm Water Pollution Control) of the IDOT Bureau of Design and Environment Manual. If practices other than those discussed in Chapter 41 are selected for implementation or if practices are applied to situations different from those covered in Chapter 41, the technical basis for such decisions will be explained below.

- b. Velocity dissipation devices will be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g. maintenance of hydrologic conditions such as the hydroperiod and hydrodynamics present prior to the initiation of construction activities).

Description of storm water management controls:

1. Storm sewer pipe that leads to the Crystal Creek outlet will be oversized for detention.
 2. Lengths of ditches will be maximized to aid in pollutant filtering along with the oversizing of storm sewers and ditches.
 3. Offsite flows from the existing detention pond located at approximate station 83+00 (RT), and 87+00 (RT) will be maintained.
 4. Sediment traps located outside the final clear zone and below the elevation of the roadway subgrade will be left in place at the completion of the project.
 5. The detention pond located by the Balmoral Avenue Underpass and pump station will provide additional storm water detention. The proposed detention will maintain/reduce the release rate of water at the discharge points. The reduction in velocity of the water will reduce the potential for erosion.
 6. Permanent measures for storm water management controls will be placed as soon as possible during construction:
 - a. All ditches will be vegetated, where feasible, which will provide a buffering effect for run off contaminants
 - b. Ditches will receive permanent seeding after the final grading and topsoil have been placed.
 - c. In turf areas where low maintenance seeding is required, native prairie grasses will be used in the final landscaping design.
 - d. Wet bottom ditches will be employed before outfalls. The ditches will be oversized to contribute to detention, where feasible. If wet bottom ditches are not feasible, the ditches will be lined with riprap.
4. **Approved State or Local Laws:** The management practices, controls and provisions contained in this plan will be in accordance with IDOT specifications, which are at least as protective as the requirements contained in the Illinois Environmental Protection Agency's Illinois Urban Manual. Procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by local officials shall be described or incorporated by reference in the space provided below. Requirements specified in sediment and erosion site plans, site permits, storm water management site plans or site permits approved by local officials that are applicable to protecting surface water resources are, upon submittal of an NOI, to be authorized to discharge under the Permit ILR10 incorporated by reference and are enforceable under this permit even if they are not specifically included in the plan.

Description of procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by local officials:

See the Erosion and Sediment Control Plans and the Landscaping Plans for means and methods utilized.

5. **Contractor Required Submittals:** Prior to conducting any professional services at the site covered by this plan, the Contractor and each subcontractor responsible for compliance with the permit shall submit to the Resident Engineer a Contractor Certification Statement, BDE 2342a.
 - a. The Contractor shall provide a construction schedule containing an adequate level of detail to show major activities with implementation of pollution prevention BMPs, including the following items:
 - Approximate duration of the project, including each stage of the project
 - Rainy season, dry season, and winter shutdown dates
 - Temporary stabilization measures to be employed by contract phases
 - Mobilization timeframe
 - Mass clearing and grubbing/roadside clearing dates
 - Deployment of Erosion Control Practices
 - Deployment of Sediment Control Practices (including stabilized construction entrances/exits)
 - Deployment of Construction Site Management Practices (including concrete washout facilities, chemical storage, refueling locations, etc.)
 - Paving, saw-cutting, and any other pavement related operations
 - Major planned stockpiling operations
 - Timeframe for other significant long-term operations or activities that may plan non-storm water discharges

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- such as dewatering, grinding, etc.
 - Permanent stabilization activities for each area of the project
- b. The Contractor and each subcontractor shall provide, as an attachment to their signed Contractor Certification Statement, a discussion of how they will comply with the requirements of the permit in regard to the following items and provide a graphical representation showing location and type of BMPs to be used when applicable:
- Vehicle Entrances and Exits – Identify type and location of stabilized construction entrances and exits to be used and how they will be maintained.
 - Material Delivery, Storage and Use – Discuss where and how materials including chemicals, concrete curing compounds, petroleum products, etc. will be stored for this project.
 - Stockpile Management – Discuss what BMPs will be used to prevent pollution of storm water from stockpiles.
 - Waste Disposal – Discuss methods of waste disposal that will be used for this project.
 - Spill Prevention and Control – Discuss steps that will be taken in the event of a material spill (chemicals, concrete curing compounds, petroleum, etc.)
 - Concrete Residuals and Washout Wastes – Discuss the location and type of concrete washout facilities to be used on this project and how they will be signed and maintained.
 - Litter Management – Discuss how litter will be maintained for this project (education of employees, number of dumpsters, frequency of dumpster pick-up, etc.)
 - Vehicle and Equipment Fueling – Identify equipment fueling locations for this project and what BMPs will be used to ensure containment and spill prevention.
 - Vehicle and Equipment Cleaning and Maintenance – Identify where equipment cleaning and maintenance locations for this project and what BMPs will be used to ensure containment and spill prevention.
 - Additional measures indicated in the plan.

III. Maintenance:

When requested by the Contractor, the Resident Engineer will provide general maintenance guides to the Contractor for the practices associated with this project. The following additional procedures will be used to maintain, in good and effective operating conditions, the vegetation, erosion and sediment control measures and other protective measures identified in this plan. It will be the Contractor's responsibility to attain maintenance guidelines for any manufactured BMPs which are to be installed and maintained per manufacture's specifications.

Maintenance of Erosion and Sediment Control Systems will be the responsibility of the contractor. The contractor will be required to maintain the Erosion and Sediment Control Systems in accordance with the IDOT Erosion and Sediment Control Field Guide for Construction Inspection (<http://www.dot.il.gov/desenv/environmental/IDOT%20Field%20Guide.pdf>) and IDOT's Best Management Practices – Maintenance Guide (<http://www.dot.state.il.us/desenv/environmental/bestpractices.html>)

Maintenance procedures as outlined in the Field Guide and/or BMP Maintenance Guide are also described below for each ESC measure:

Perimeter Erosion Barrier

- Repair tears, gaps or undermining. Restore PEB and ensure taut.
- Repair or replace any missing or broken stakes immediately.
- Clean PEB if sediment reaches one-third height of barrier.
- Remove PEB once final stabilization establishes since PEB is no longer necessary and should be removed.
- Repair PEB if undermining occurs anywhere along its entire length.

Temporary Erosion Control Seeding

- Reapply seed if stabilization hasn't been achieved.
- Apply temporary mulch to hold seed in place if seed has been washed away or found to be concentrated in ditch bottoms.
- Restore rills, greater than 4 inches deep, as quickly as possible on slopes steeper than 1V:4H to prevent sheet-flow from becoming concentrated flow patterns.
- Mow, if necessary to promote seed soil contact when excessive weed development occurs, a common indication of ineffective temporary seeding.
- Supplement BMP if weather conditions (extreme heat or cold) are not conducive for germination.

Mulch

- Repair straw if blown or washed away, or if hydraulic mulch washes away.
- Place tackifier or an Erosion Control Blanket if mulch does not control erosion.

Soil & Mulch Binders

- Reapply soil binders after heavy rainfall events if spot failures occur.
- Check manufacturer's specification for re-application criteria.

Erosion Control Blanket (ECB)

- Repair damage due to water running beneath the blanket and restore ECBs when displacement occurs. Reseeding may be necessary.

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- Replace all displaced ECBs and restaple.

Perimeter Erosion Barrier (PEB)

- Repair tears, gaps or undermining. Restore leaning PEB and ensure taut.
- Repair or replace any missing or broken stakes immediately.
- Clean PEB if sediment reaches one-third height of barrier.
- Remove PEB once final stabilization establishes since PEB is no longer necessary and should be removed.
- Repair PEB if undermining occurs anywhere along its entire length.

Temporary Ditch Check

- Remove sediment from upstream side of ditch check when sediment has reached 50% of height of structure.
- Repair or replace ditch checks whenever tears, splits, unraveling or compressed excelsior are apparent.
- Replace torn fabric mat that may allow water to undermine the ditch check. Remove debris (garbage) when observed on check. Reestablish the flow over the center of the ditch check. Water or sediment going around the ditch check indicates incorrect installation. Device needs lengthening or the selected device is inappropriate for the site conditions.
- Remove ditch checks once all upslope areas are stabilized, seed or otherwise stabilize TDC area(s)

Storm Drain Inlet Protection (Inlet Filters)

- Remove sediment from inlet filter basket when basket is 25% full or 50% of the fabric pores are covered with silt.
- Remove ponded water on road surfaces immediately.
- Clean filter if there is water standing in the filter for more than 1 hour following a rain event.
- Remove trash accumulated around or on top of practice. Replace filter if tears are observed.

Temporary Pipe Slope Drain

- Fill eroded area at inlet with well-compacted soil immediately. Stabilize outfall to eliminate further scour.
- Repair leaks along length of pipe and re-compact soil to stabilize pipe.
- Reconnect pipe at joints when separation occurs. Restore or increase anchors along length of pipe to ensure pipe stability. If slope drain washes out it may be necessary to use aggregate-lined channels or additional drains.

Outlet Protection

- Restore dislodged protection at outlet structures and correct erosion that may occur.
- Remove sediment buildup that deposits in the protection.
- Remedy deficient areas, prone to increased erosion, immediately to prevent greater deficiencies.
- Remove sediment when voids are full and replace protection. Protection is reusable if the accumulated sediment is removed.
- Temporary devices (temporary pipe slope drains) should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

Temporary Sediment Basin

- Remove accumulated silt when the basin becomes 50% filled.
- Maintain the outlet structure to prevent clogging. Woven monofilaments are preferred over fabrics, and produce better results. Skimmers remove the clearest runoff first.
- Correct erosion at outlet and provide stabilization if necessary.
- Repair areas that allow seepage from the basin.
- Implement other BMPs, such as an Advance Treatment System (anionic polymers); if sediment discharges or other pollutants are identified at the discharge point to appropriately address pollutants.
- Replace/augment armoring at the outfall as needed to reestablish outfall integrity.
- The presence of stagnant water can result in mosquito larvae, requiring treatment. Mosquito larvae will trigger pumping through and Advanced Treatment System (anionic polymers) or treatment with larvicide. Contact District Environmental staff for guidance.
- Regrade base if ponding observed.

Temporary Sediment Trap

- Clean trap of silt when trap becomes 50% full.
- Implement other BMPs, such as sand filters, to filter pollutants if sediment discharges or other pollutants are identified at the discharge point.
- Regrade to drain.

Protect Existing Vegetation & Natural Features

- Replace damaged vegetation with similar species. Check with designer for appropriate replacements.
- Restore areas disturbed or damaged by the Contractors to pre-construction conditions or better at no additional expense to the contract.
- Trim any cuts, skins, scrapes or bruises to the bark of the vegetation and utilize local nursery accepted procedures to seal damaged bark.
- Prune all tree branches broken, severed or damaged during construction. Cut all limbs and branches, on-half inch or greater in diameter, at the base of the damage, flush with the adjacent limb or tree trunk.
- Smoothly cut, perpendicular to the root, all cut, broken, or severed, during construction, roots one inch or greater in diameter.

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- Cover roots exposed during excavation with moist earth and/or backfill immediately to prevent roots from drying.

Stockpile Management

- Repair and/or replace perimeter controls and stabilization measures when stockpile material has potential to be discharged or leave the limits of protection.
- Remove all off-tracked material by sweeping or other methods.
- Update the SWPP anytime a stockpile location has been removed, relocated, added, or required maintenance.
- Handle contaminated soil stockpiles according to Article 669.11 Temporary Staging in the Standard Specifications.
- During summer months, water stockpiles to maintain the crop cover.

Stabilized Construction Exits

- Replenish stone or replace exit if vehicles continue to track sediment into the roadway from the construction site.
- Sweep sediment on roadway from construction activities immediately.
- Ensure culverts are free from damage.
- Use street sweeping in conjunction with this BMP to remove sediment not removed by the stabilized construction exit.

Tire Wash Station

- Adjust truck activity through better fueling operation, fixing leaks and wiping off excess grease to minimize pollutant discharge. Inspect tire wash discharge for evidence of oils, grease, petrol or other chemicals removed by the tire wash procedures. Alternatively, additional contaminant removal procedures may be required to remove petrochemicals.

Temporary Concrete Washout Facilities

- Remove washout water from high volume facilities with a vacuum truck and dispose of properly. Do not discharge wastewater into the environment. (Note: acidity, not particulates, is environmentally hazardous)
- Do not discharge washout water into the environment; facilitate evaporation of low volume washout water.
- Clean and remove any discharges within 24 hours of discovery.
- If effluent cannot be removed prior to the anticipated rainfall event, place and secure a non-collapsing, non-water collecting cover over the washout facility to prevent accumulation and precipitation overflow.
- Replace damaged liner immediately.
- Remove temporary concrete washout facilities when no longer needed and restore disturbed areas to original condition.
- Dispose of solidified concrete waste, considered Lean Construction or Demolition Debris (CCDD) as per the IEPA Act (415 ILCS5).

Material Delivery & Storage

- Document the various types of materials delivered and their storage locations in the SWPP.
- Update the SWPP anytime significant changes occur to material storage or handling locations and when they have been removed.
- Cleanup spills immediately.
- Remove empty containers.

Solid Waste Management

- If containers are full, empty them immediately.
- Update the SWPP anytime a Contractors' trash management plan significantly changes.
- Correct items discarded outside of designated areas.

Vehicle and Equipment Fueling, Cleaning and Maintenance

- Cleanup spills immediately.
- Contractor must provide documentation that spills were cleaned, materials disposed of and impacts mitigated.
- Update the SWPP when a designated location has been removed, relocated, added, or required maintenance.
- Any spills discharged through a drainage system will require the submission of an ION.
- In the event of a spill into a storm drain, waterway or onto a paved surface such as a parking lot, street, driveway or other surface connect to the storm water drainage system, the owner of the fuel must immediately take action to contain the spill.
- Once contained, clean up the spill. As initial step this may involve collecting any bulk material and placing it in a secure container for later disposal. Follow up cleaning will also be required to remove residues from paved or other hard surfaces.

Extended Work Cessation/Shutdown

- Maintain ESC during a shutdown. This includes winter shutdown and spring snowmelt prior to construction restart where the Contractor must install appropriate BMPs and provide timely regular maintenance.
- Inspection frequencies during winter or project shutdown are as required under the ILR10 Permit.
- The important aspect of winter shutdown inspection is to ensure there is limited sediment and other pollutants to escape the project site.
- Seeding is the most cost effective erosion control practice. Seeding must be laid down and mulched so the plants are viable before the first frost, through the shutdown, and are ready for the spring thaw. While snow cover is a viable winter temporary cover, spring will be a challenge if the seeding is not viable. Plants that are too young at first frost die. Most seeders are extremely busy in fall. Therefore, a good approach to winter shutdown seeding is to seed as many areas as possible as close to the fall seeding start date as possible.

- Inspect periodically for scour or dislodged stones and replace stones as needed.
 - Remove woody vegetation
- Dust Control
- Implement the Dust Control Plan as required by IDOT Standard Specifications for Road and Bridge Construction

IV Inspections:

Qualified personnel shall inspect disturbed areas of the construction site which have not yet been finally stabilized, structural control measures, and locations where vehicles and equipment enter and exit the site using IDOT Storm Water Pollution Prevention Plan Erosion Control Inspection Report (BC 2259). Such inspections shall be conducted at least once every seven (7) calendar days and within twenty-four (24) hours of the end of a storm that is 0.5 inch or greater or equivalent snowfall.

If any violation of the provisions of this plan is identified during the conduct of the construction work covered by this plan, the Resident Engineer shall notify the appropriate IEPA Field Operations Section office by email at: epa_swnoncomp@illinois.gov, telephone or fax within twenty-four (24) hours of the incident. The Resident Engineer shall then complete and submit an "Incidence of Non-Compliance" (ION) report for the identified violation within five (5) days of the incident. The Resident Engineer shall use forms provided by IEPA and shall include specific information on the cause of noncompliance, actions which were taken to prevent any further causes of noncompliance, and a statement detailing any environmental impact which may have resulted from the noncompliance. All reports of non-compliance shall be signed by a responsible authority in accordance with Part VI. G of the Permit ILR10.

The Incidence of Non-Compliance shall be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attn: Compliance Assurance Section
1021 North Grand East
Post Office Box 19276
Springfield, Illinois 62794-9276

V. Failure to Comply:

Failure to comply with any provisions of this Storm Water Pollution Prevention Plan will result in the implementation of a National Pollutant Discharge Elimination System/Erosion and Sediment Control Deficiency Deduction against the Contractor and/or penalties under the Permit ILR10 which could be passed on to the Contractor.

Added 1/8/2013



Contractor Certification Statement

Prior to conducting any professional services at the site covered by this contract, the Contractor and every subcontractor must complete and return to the Resident Engineer the following certification. A separate certification must be submitted by each firm. Attach to this certification all items required by Section II.5 of the Storm Water Pollution Prevention Plan (SWPPP) which will be handled by the Contractor/subcontractor completing this form.

Route	<u>Mannheim Road</u>	Marked Rte.	<u>F.A.P. 330 (US 12/45)</u>
Section	<u>0105-WRS-1</u>	Project No.	<u>P-11-103</u>
County	<u>Cook</u>	Contract No.	<u>60G37</u>

This certification statement is a part of the SWPPP for the project described above, in accordance with the General NPDES Permit No. ILR10 issued by the Illinois Environmental Protection Agency.

I certify under penalty of law that I understand the terms of the Permit No. ILR 10 that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

In addition, I have read and understand all of the information and requirements stated in the SWPPP for the above mentioned project; I have received copies of all appropriate maintenance procedures; and, I have provided all documentation required to be in compliance with the Permit ILR10 and SWPPP and will provide timely updates to these documents as necessary.

- Contractor
- Sub-Contractor

_____	_____
Print Name	Signature
_____	_____
Title	Date
_____	_____
Name of Firm	Telephone
_____	_____
Street Address	City/State/ZIP

Items which this Contractor/subcontractor will be responsible for as required in Section II.5. of the SWPPP:

Added 1/8/2013

AGGREGATE SURFACE COURSE FOR TEMPORARY ACCESS (D-1)

Effective: April 1, 2001

Revised: January 2, 2007

Revise Article 402.10 of the Standard Specifications to read:

“402.10 For Temporary Access. The contractor shall construct and maintain aggregate surface course for temporary access to private entrances, commercial entrances and roads according to Article 402.07 and as directed by the Engineer.

The aggregate surface course shall be constructed to the dimensions and grades specified below, except as modified by the plans or as directed by the Engineer.

- (a) Private Entrance. The minimum width shall be 12 ft (3.6 m). The minimum compacted thickness shall be 6 in. (150 mm). The maximum grade shall be eight percent, except as required to match the existing grade.
- (b) Commercial Entrance. The minimum width shall be 24 ft (7.2 m). The minimum compacted thickness shall be 9 in. (230 mm). The maximum grade shall be six percent, except as required to match the existing grade.
- (c) Road. The minimum width shall be 24 ft (7.2 m). The minimum compacted thickness shall be 9 in. (230 mm). The grade and elevation shall be the same as the removed pavement, except as required to meet the grade of any new pavement constructed.

Maintaining the temporary access shall include relocating and/or regrading the aggregate surface course for any operation that may disturb or remove the temporary access. The same type and gradation of material used to construct the temporary access shall be used to maintain it.

When use of the temporary access is discontinued, the aggregate shall be removed and utilized in the permanent construction or disposed of according to Article 202.03.”

Add the following to Article 402.12 of the Standard Specifications:

“Aggregate surface course for temporary access will be measured for payment as each for every private entrance, commercial entrance or road constructed for the purpose of temporary access. If a residential drive, commercial entrance, or road is to be constructed under multiple stages, the aggregate needed to construct the second or subsequent stages will not be measured for payment but shall be included in the cost per each of the type specified.”

Revise the second paragraph of Article 402.13 of the Standard Specifications to read:

“Aggregate surface course for temporary access will be paid for at the contract unit price per each for TEMPORARY ACCESS (PRIVATE ENTRANCE), TEMPORARY ACCESS (COMMERCIAL ENTRANCE) or TEMPORARY ACCESS (ROAD).

Partial payment of the each amount bid for temporary access, of the type specified, will be paid according to the following schedule:

- (a) Upon construction of the temporary access, sixty percent of the contract unit price per each, of the type constructed, will be paid.
- (b) Subject to the approval of the Engineer for the adequate maintenance and removal of the temporary access, the remaining forty percent of the pay item will be paid upon the permanent removal of the temporary access.”

ERECTING STRUCTURAL STEEL

Description: This work shall consist of all labor, materials, tools and equipment necessary for the erection of structural steel, which will be furnished by others under a separate contract, as per the details included in the plans, according to the applicable portions of Sections 505 and 506 of the Standard Specifications and these special provisions. The shim plates and neoprene pads for the bearings will be furnished by others under a separate fabrication contract; the installation of these items shall be included in the cost for erecting structural steel. The Contractor for furnishing of structural steel is herein referred to as Fabrication Contractor, and the Contractor for erection of these items is referred to as Erection Contractor.

Erection: The structural steel shall be erected according to the requirements of Article 505.08 of the Standard Specifications and this special provision.

Field Painting: The Erection Contractor shall be responsible for field touch-up painting, and spot cleaning and painting of the damaged coatings on newly erected work. The paint coatings shall be compatible with the paint system used by the Fabrication Contractor.

Article 505.09 of the Standard Specifications shall be amended to add the following:

4. No extra compensation will be allowed for touch-up field painting of steel members which have been burred and marred at the time of shipping or erecting and all other areas of the new structural steel surfaces where the paint coatings have been removed or are incomplete.
5. The structural steel and the fixed steel bearings including shim plates and neoprene pads for the bearings will be furnished and delivered under a separate fabrication contract.

Delivery of structural steel and bearings to the site shall be coordinated with the Fabrication Contractor to permit the erection of the steel in stages without delaying the progress of the steel erection. The Erection Contractor shall provide the Fabrication Contractor with a working schedule for shipping the structural steel and bearings to the jobsite, within 30 calendar days after the execution of the erection contract. The Erection Contractor shall

notify the Fabrication Contractor a minimum of three calendar weeks in advance for any changes in the scheduled delivery dates. Copies of all notifications and correspondence between the Erection Contractor and Fabrication Contractor shall be submitted promptly to the Engineer.

For bidding purposes only, it is anticipated that the delivery of the structural steel will be required on or before the dates given in the following table:

Delivery Stage	Structure Construction Stage	Structure Construction Area	Delivery Dates
1	Stage I	FAP 330, N.B. Mannheim Road Over S.B. Mannheim Road Exit Ramp Girders 1 thru 12	June 10, 2013
2	Stage 2	FAP 330, S.B. Mannheim Road Over S.B. Mannheim Road Exit Ramp Girders 1 thru 8	September 30, 2013

These dates are the scheduled delivery dates. The Engineer will confirm these dates.

- The Fabrication Contractor will provide one (1) reproducible copy of all approved fabrication shop drawings to the Erection Contractor for use during erection of the fabricated structural steel. Shop drawings will include a list and location of the field bolts required.

Basis of Payment: The erecting of structural steel will be measured and paid for according to Section 505 of the Standard Specifications.

KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC

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 Maintenance of Traffic plans

The Contractor shall maintain two through lanes with a minimum width of 11 feet per lane in each direction of the Mannheim Road at all times. Daily arterial lane closures shall be in accordance with the Standard Specifications, Highway Standards and the direction of the Engineer. The Contractor shall request and gain approval from the Illinois Department of Transportation's Arterial Traffic Control Supervisor at (847-705-4470) seventy-two (72) hours in advance of all long term (24 hrs. or longer) lane closures.

Arterial lane closures will only be permitted during the **off-peak** traffic volume hours. **Peak traffic volume hours are defined as weekdays (Monday through Friday) from 6:00 AM to 8:00 AM and 4:00 PM to 6:00 PM.**

In addition to other restrictions on lane closures and shoulder closures found in the contract these additional restrictions apply: during the following holiday periods no lane closures or shoulder closures will be allowed on I-190 or the ramps to and from I-190 and Mannheim Road. Also no work will be allowed that interferes with height restrictions near or around the airport.

- 3:00 p.m. Friday, November 22, 2013 to 9:00 a.m. Monday, December 2, 2013
- 3:00 p.m. Friday, December 20, 2013 to 11:59 p.m. Sunday, January 5, 2014

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 at All State Arena and The Dome at the Ball Park, or any other major events as identified by Resident Engineer.

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.

Full closure of arterial lanes will only be permitted for a maximum period of 15 minutes during the **off-peak** traffic volume hours. During full roadway closures, the Contractor will be required to reduce the roadway to only one open traffic lane in the affected direction of travel using the appropriate State Standard. Police forces shall be notified and requested to close the remaining lane to facilitate the necessary work activities. The Contractor shall notify the District One Arterial Traffic Control Supervisor at (847) 705-4470 seventy-two (72) hours in advance of the proposed road closure.

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 locations approved by the Engineer.

AIRPORT SAFETY & SECURITY (SECTION M-103)

PART 1 DESCRIPTION

1.01 GENERAL

- A. The work for this project will occur within, adjacent to, or in the vicinity of the Aircraft Operations Area (AOA) and is subject to the operational safety and security requirements of the Chicago Department of Aviation (CDA) and the FAA. The Contractor must comply with any additional requirements as may be deemed necessary by the aforementioned organizations at no cost to the Owner.
- B. During the performance of Airport Safety and Security work the Contractor must adhere to the applicable provisions set forth in Part Two General Conditions, Article XIV – Safety and Environment and Article XV – Airport Security and Operations, Airport Safety and Security, Federal Aviation Regulation (FAR) Part 139 and Part 77, O’Hare International Airport Certification Manual (ACM) and as described herein.
- C. Contractor must carry out his operations in a manner that must minimize interference with air traffic, and must cooperate with the FAA, the Engineer and CDA, the Airlines, and other Contractors working in the area. The Contractor must designate a full-time safety representative for the Project in accordance with Paragraph XIV. B of Part 2 - General Conditions. All work must be completed in accordance with the Chicago Department of Aviation’s Airport Construction Safety Manual, the Construction Phasing Plans, FAR Part 139, FAR Part 77, all applicable FAA Advisory Circulars (AC’s), the O’Hare International Airport Certification Manual, and the Contract Documents.
- D. All personnel that will be badged and allowed to perform work or duties within the AOA must complete the mandatory “303 Training” every year. Refer to the *CDA Standard Notes on General Requirements* for the requirements and details of the “303 Training”.
- E. Refer to the *CDA Standard Notes on General Requirements* for requirements and details on Traffic Control, Safety Requirement, and ID Badging Process; Staging and Storage Areas; and FAR Part 139 Requirements.
- F. All vehicles and vehicle operations must comply with the Chicago Airport System, O’Hare and Midway International Airports, Ground Motor Vehicle Operation Regulation Manual, latest edition.
 - 1. All vehicles must be equipped with flashing yellow lights and must have their headlights and flashing yellow lights turned on at all times while on the airfield or Aircraft Operations Area (AOA).
- G. The Contractor must supply, place, maintain, move and store the items listed herein, as appropriate, to facilitate construction and protect air traffic. An adequate extra supply of these items must be available on site at all times.

PART 2 EQUIPMENT AND MATERIALS

2.01 WARNING LIGHTS

- A. Warning lights must be flashing red lights meeting the requirements of the latest edition of the "Manual on Uniform Traffic Control Devices" for Type A and Type B flashers.

2.02 WARNING MARKERS

- A. Warning markers must be the type and size detailed on the Plans. Markers must be equipped with a red warning light per Paragraph 2.01.

2.03 BARRICADES

- A. Barricades must be Class A barricades, as detailed on the Plans. The stabilization tube must consist of alternating orange and white fluorescent stripes and must be filled with sand to prevent damage or dislodging resulting from jet blast. Each barricade must be equipped with a red light as detailed on the Plans. An adequate supply of such barricades must be kept on the Project site. The barricades must be placed in locations as directed by the Engineer and CDA.

2.04 TEMPORARY RUNWAY/TAXIWAY CLOSED DEVICES AND SYMBOL

- A. The runway/taxiway closed devices must be portable lighted "X". Closure symbols may be signified by double-layer painted colored plastic fence, painted sheets of plywood, P-620 paint or similar materials if they have proper layout and are properly secured to prevent movement by prop wash, jet blast or other wind currents.

2.05 TEMPORARY SAFETY AREA MARKING

- A. All safety areas (RSA and TSA) and NAVAID critical areas affected by construction work must be designated and marked with a clearly visible fence. The fence must be made of wood posts or stakes and a durable orange fabric stapled to the posts.
- B. Wood supports must meet the following requirements:
 - 1. Posts/stakes must be kiln dried oak or hickory.
 - 2. Posts/stakes must be peeled, sound, straight-grained, and free from decay, cracks, and splits.
 - 3. Posts/stakes must be 48 inches long and have a cross section of 2 inches by 2 inches.

4. Outer bark must be completely removed from all posts/stakes including depressions.
 5. Support and bracing of wood posts/stakes, where needed must be of the same material and quality as the wood supports
- C. Fabric must be 24 inch wide and orange in color. Fabric must be woven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride and meet the following requirements:
1. Minimum grab tensile strength in the machine direction per ASTM D4632 = 120 lb (550 N)
 2. Minimum grab tensile strength in the cross machine direction per ASTM D4632 = 100 lb (450 N)
 3. Minimum ultraviolet stability, percent of strength retained after 500 hours exposure per ASTM D4355 = 70%
- D. Fabric must be stapled to the wood supports using No. 9 galvanized steel wire staples that are at least 1 inch long but no longer than 1-1/2 inches. Staples must be $\frac{3}{4}$ inch wide.

2.06 TEMPORARY UNDERGROUND UTILITY MARKING

- A. Prior to start of earthwork, all underground utilities (to include but not limited to FAA ducts and cables, electrical and ComEd ductbanks and cables, telephone and communication lines, gas mains, watermains and sewer pipes, fuel lines, etc.) on the work area must be delineated with 2 inch diameter and 5 feet minimum length Schedule 40 PVC pipe posts with APWA colored labels identifying the specific utility type or as directed by the Engineer and CDA.
- B. Install the temporary underground utility marking in accordance with Paragraph 3.20.

PART 3 CONSTRUCTION METHODS

3.01 CONTROL REQUIREMENTS

- A. The Contractor will be held responsible for controlling his employees and his Subcontractors and their employees, with regard to traffic movement.
- B. The Contractor must rebuild, repair, restore, and make good at his own expense all injuries or damages to any portion of the work occasioned by his use of these facilities before completion and acceptance of the work.
- C. The Contractor must submit to the Engineer and CDA in writing a detailed construction operation plan as outlined in Paragraph IV. D of Part II, General

Added 1/8/2013

Conditions. The plan must include, but not be limited to, construction sequencing of earthwork, paving, drainage, airfield lighting, signing and electrical systems, equipment haul roads, light plants and maintenance of airfield electrical and NAVAID power and control circuits. The plan must also include a breakdown of the work in each construction phase, as described in the Construction Phasing Plans. At least 14 calendar days before commencing work in each phase, an updated plan must be submitted for approval. No work within the construction phase may commence until the phase work plan is approved.

- D. The Contractor must submit to the Engineer and CDA in writing an Airport Traffic Management Plan, as outlined in Paragraph IV. D of Part II, General Conditions. The plan must address the control of construction equipment and vehicular movements for each construction phase.
- E. The Contractor must provide a responsible Traffic Manager whose duty will be to direct all traffic on or near active runways, taxiways, haul roads, and highways. Paved surfaces must be kept clear at all times and specifically must be kept free from all debris which might damage aircraft.
- F. The Contractor must prepare a security badge control plan for review by the Engineer and CDA. The plan must be submitted prior to or at the Pre-Construction Meeting. No work may commence until this plan is approved. The plan must be prepared on the Contractor's company letterhead and signed by the company representative who is authorized to sign the badge applications. The plan must describe, in detail, the Contractor's and/or Subcontractor's plan to control badges.
- G. The Contractor must submit to the Engineer and CDA in writing a detailed safety plan that outlines the procedures and methods intended to be used to maintain the safety of the airfield, the traveling public and the Contractor's employees. The plan must be broken down by each construction phase and must be submitted at least 14 days prior to beginning construction. No work may commence until the Contractor's safety plan is approved in writing and can be immediately implemented. The plan should address the following items, as applicable:
 - 1. Scope of work to be performed, including proposed duration of work.
 - 2. Procedures and methods of protecting and maintaining all runway and taxiway lighting fixtures and conditions of all pavement marking.
 - 3. Procedures for protecting all runway and taxiway operational areas as shown on the Construction Phasing Plans. This includes limitations on equipment height and stockpiled materials.
 - 4. Areas and operations affected by the construction activity, including possible safety problems.
 - 5. NAVAIDs that could be affected, especially critical area boundaries, and temporary marking of underground FAA utilities.
 - 6. Methods of separating vehicle and pedestrian construction traffic from the Airport movement areas. This may include barricades, barriers, or fencing off construction areas to keep equipment operators in restricted

areas in which they are authorized to operate. Fencing, or some other form of restrictive barrier, is an operational necessity in some cases.

7. Procedures and equipment, such as barricades (identify type), to delineate closed construction areas from the Airport operational areas, as necessary.
8. Limitations on construction.
9. Required compliance of Contractors or personnel with all Airport safety and security measures.
10. Location of stockpiled construction materials, construction site parking, and access and haul roads.
11. Radio communications.
12. Vehicle information.
13. Trenches and excavations and cover requirements.
14. Procedures for notifying ARFF personnel if water lines or fire hydrants must be deactivated or if emergency access routes must be rerouted or blocked.
15. Emergency notification procedures for medical and police response.
16. Use of temporary visual aids.
17. Wildlife management.
18. Foreign object debris (FOD) control provisions.
19. Hazardous materials (HAZMAT) management.
20. Notice to Airmen (NOTAM) issuance.
21. Inspection requirements.
22. Procedures for locating and protecting existing underground utilities, cables, wires, pipelines and other underground facilities in excavation areas.
23. Procedures for contacting responsible representatives / points of contact for all involved parties. This should include off-duty contact information so an immediate response may be coordinated to correct any construction-related activity that could adversely affect the operational safety of the Airport. Particular care should be taken to ensure that appropriate Airways Facilities personnel are identified in the event that an unanticipated utility outage or cable cut occurs that impacts FAA NAVAIDs.
24. Vehicle operator training.
25. Penalty provisions for noncompliance with Airport rules and regulations and the safety plan (e.g., if a vehicle is involved in a surface incident).

- 26. Any special conditions that affect the operation of the Airport and will require a portion of the safety plan to be activated (e.g., low-visibility operations, snow removal).
- H. The Contractor must provide a responsible full time safety representative whose duty it is to monitor Contractor activities for compliance with all federal, state and local laws. This person must be on-site at all times when any construction activity or setup is taking place.

3.02 VEHICLE AND PEDESTRIAN CONTROL

- A. Vehicle and access routes for Airport construction will be controlled as necessary to prevent inadvertent or unauthorized entry of persons, vehicles or animals onto the Air Operations Area (AOA). No vehicle will enter the AOA except at predetermined locations. The amount of construction traffic will require the Contractor to use security guards at access gates and flagpersons to control traffic crossing active taxiways. Two (2) bonded security guards are required at each access location when the Contractor works airside. Crossing of runways is to be avoided if at all possible. Any runway crossings that may be necessary must be approved by the Engineer and CDA. Any vehicle crossing a runway must receive clearance through the CDA from the ATCT specifically Ground Control on their frequency. The Contractor is not to contact the ATCT directly. Contractor personnel who operate vehicles in the AOA must comply with the Airport operator's rules and regulations for vehicle marking, lighting, and operation as described in Article XV – Airport Security and Operations of Part 2 – General Conditions. Failure to comply may result in fines.

3.03 CONTROL AND WARNING DEVICES

- A. The Contractor must furnish and maintain warning markers as detailed on the Plans at the locations designated by the Engineer and CDA. The Contractor must maintain warning markers and red warning flags around all equipment, stockpiles, or other areas as directed by the Engineer and CDA.
- B. The Contractor must provide the phone numbers of three (3) of its personnel, including the Project superintendent, who may be contacted in an emergency. Personnel must be on call 24 hours per day for maintaining warning markers. The Contractor will employ watchmen to maintain and service all traffic control equipment.

3.04 VEHICLE MARKING AND IDENTIFICATION

- A. Large construction vehicles used on a job site located in the AOA must display in full view above the vehicle a 3' x 3' or larger, orange and white checkerboard flag, each checkerboard color being 1' square. Construction vehicles include but are not limited to: bull dozers, earth moving vehicles, paving machines, excavating machines, grinders, backhoes, lifting cranes, etc. Any construction vehicle operating in the AOA must be equipped with a flashing amber (yellow) dome-type light, mounted on top of the vehicle and of such intensity to conform to local codes for maintenance and emergency vehicles. All vehicles operating

within the airfield boundary must be identified with a sign on each side of the vehicle bearing the Contractor's name.

- B. All other vehicles that do not fall into the category in 3.04.A, must be equipped with a rotating or flashing yellow light (strobe, LED, or incandescent) mounted on the top of the vehicle and the light must be visible and in operation anytime the vehicle is on the AOA.
- C. Vehicles making only occasional visits to the job site are exempt from the identification requirements contained above provided that a properly identified vehicle escorts them into, through, and out of the AOA. These and other vehicles needing intermittent identification may be marked with tape or with magnetically attached markers that are commercially available.

3.05 VEHICLE TRAFFIC AND OPERATIONS

- A. When any vehicle other than those approved for use in the AOA is required to travel to or from the work area or over any portion of the work area, it must be escorted by a vehicle properly identified to operate in the area and be provided with a flag on a staff attached to the vehicle. All construction vehicles/equipment must have automatic signaling devices to sound an alarm when moving in reverse. All equipment must be operated within the approved speed limit(s).

3.06 VEHICLE PARKING

- A. All vehicles must be parked and serviced in the designated staging and employee parking areas. The Contractor is responsible for transporting his/her employees from these areas to the jobsite.

3.07 RADIO COMMUNICATIONS

- A. The control of vehicular activity on the AOA is of the highest importance and requires coordination with the Airport users and the Air Traffic Control Tower (ATCT). The Contractor will have no direct contact with ATCT Ground Control. All communications with ATCT will be coordinated through the Engineer and CDA personnel. However, the Contractor must properly train his/her personnel, particularly flagpersons, on the proper procedures for monitoring radio frequencies.
- B. All vehicles and/or construction equipment operating inside the active AOA, but outside of the designated haul roads, must be escorted by CDA personnel, who will maintain radio contact with the ATCT. Crossing an active runway will not be permitted. Vehicular traffic crossing an active taxiway will be controlled by the CDA via two-way radio with the ATCT and through the use of a CDA escort or a flagperson. Active runways and taxiways are those pavements being used for the operation of aircraft. The clearance will be through the CDA escort and confirmed by the driver's personal observation that no aircraft is approaching his/her position. Aircraft always have the right-of-way and construction equipment must always yield to aircraft.
- C. The Contractor must have a flagperson stationed on each side of an active taxiway crossing to monitor aircraft movement and to direct construction traffic.

The flagperson must be equipped with handheld signs or flags to assist in the direction of construction traffic. The flagperson must also be equipped with lighted wands and light plants on each side of the taxiway during nighttime construction. In addition, one vacuum sweeper must be dedicated to and stationed full time at each active taxiway crossing to maintain the surface of the taxiway free from construction traffic debris. Mud and other material tracked onto taxiway surfaces must be removed by hand if necessary to achieve its complete removal. The Contractor must arrange a physical inspection of the completed work area with CDA for inspections prior to opening for aircraft use any runway, taxiway, ramp area or Airport roadway that has been closed for work, or that has been used for a crossing point or haul route by the Contractor.

3.08 AIRPORT SECURITY REQUIREMENTS

- A. The Airport is operated in strict compliance with Federal Aviation Regulation (FAR) Part 107, 49 CFR Parts 1520 (Protection of Sensitive Security Information), 1540 (Civil Aviation Security), and 1542 (Airport Security), which prohibits unauthorized persons or vehicles in the AOA. Yearly "303 Training" is mandatory for all personnel that will be badged and allowed to perform work or duties within the AOA. Equipment and personnel will be restricted to the work area defined on the Plans. Any violations by Contractor's personnel will subject the Contractor to penalties imposed by the FAA and the CDA Airport Security Office.
- B. Airport restricted areas are fenced and must remain fenced at all times. Any required temporary security fences and/or gates will be constructed by the Contractor. Temporary fencing must be constructed as shown on the Plans and in accordance with Section F-162 or 02820. The gates will remain closed and locked, or if it is being continuously used for ingress and egress, a gate operator will be provided at the Contractor's expense. The Contractor must furnish the gate operator with a roster of personnel and ensure that each individual has adequate identification. Interlocking locks supplied by the Contractor will not be allowed.
- C. Gate guards, as required by Part Two of the Contract documents, provided by the Contractor will be provided direct and/or indirect methods of communications to contact the CDA. Direct access is defined as a guard having immediate access to a telephone. Indirect access is defined as the guard having a radio that communicates with an individual who has direct access. Gate guards are to be instructed on rules of performance relative to AOA Security. Entrance to the airfield is subject to strict security regulations. All personnel entering the airfield must obtain and display security identification badges and all vehicles must have and display special permits which are available through the CDA Security Badge Office. All vehicles are subject to inspection upon entering the AOA. All vehicles may be searched each time prior to entering or exiting the security checkpoint and may be subject to random searches while operating in the AOA.
- D. All vehicle deliveries must be coordinated in advance. The persons escorting the delivery will coordinate with the Engineer and CDA. The vehicle license plate

and expected delivery time must be provided. The Contractor may compile the expected daily delivery schedule on one (1) sheet for submission to the Engineer and CDA. The vehicle operator must have in his or her possession a commercial manifest, which identifies the contents of the vehicle and/or trailer. An escort from the company for whom the shipment is intended must respond to the vehicle access gate and remain with the vehicle until the vehicle exits the secured area. Once the vehicle search is completed, vehicles will be permitted escorted access to their delivery point. Priority consideration may be offered to concrete trucks, with resulting delays estimated to be 20 minutes. To receive priority consideration, concrete deliveries must be scheduled with Airport security at the time of batching. These requirements may severely reduce throughput of vehicles entering the AOA at these check points, thereby potentially affecting the execution time of some construction activities. The Contractor must account for the possible loss of time associated with these vehicle searches in his/her bid. No additional time or compensation will be permitted for actions resulting from these vehicle searches.

- E. The Contractor must maintain the security integrity between the public and the AOA. All barrier designs and their phasing must be submitted to and approved by the Engineer and CDA, in writing, prior to erection.
- F. All construction personnel assigned to the Project, except for escorted in-transit material suppliers, must make application for and wear security badges. The prime Contractor and the Subcontractor can make application for these items by contacting the City of Chicago CDA at (773) 894-3828 (Badging Office) to make arrangements. The Contractor must comply with all provisions of the latest version of the Chicago Airport System Security Credentials Manual Policy and Procedures Handbook. The Contractor will be responsible for assuring that all employees have background checks performed in accordance with CDA security badging procedures. Photo identification badges will be made for each employee. Replacement cost for lost badges is \$50.00. Badges must be surrendered upon termination of the employee or Contract.
- G. Company official/officials listed on the company application for AOA access must sign each individual employee badge application form and state why the individual badge is required.
- H. The Contractor must maintain an up-to-date record of all badge holders showing name, address, sex, height, weight, eye color and badge number. The Contractor will be required to furnish this information to the Airport upon request.
- I. The Contractor must restrict passage into the secured area to badged persons, vehicles and equipment displaying company identification or that of the Airport. Should the Contractor wish to allow visitors, vendors or delivery vehicles through access points, the following items must be provided:
 - 1. A method, acceptable to the CDA, of temporarily placing company identification on each person or vehicle. (An acceptable alternate will be to provide an escort for each person or vehicle).

2. Each person or vehicle entering the secured area displaying the Contractor's identification or under escort will carry the full coverage of his liability and property damage.
- J. The Contractor will be responsible to provide at his own cost an escort service for all vehicles that do not operate on a daily basis within the AOA. Escorted vehicles must not be left unattended. Any escorted vehicle allowed on the AOA by the Contractor must be escorted back and forth to the point of entry.
- K. The Contractor is required to submit a plan on how he/she will safely operate within the AOA. This plan must be submitted and approved by the Engineer and CDA before the commencement of any construction.
- L. The Contractor will contact the Security Manager, telephone (773) 894-3828 ten (10) days prior to start of construction to submit the necessary Airport security information for all vehicles and personnel required inside the restricted area during construction.

3.09 VIOLATION OF RESPONSIBILITIES

- A. Any violation of Paragraphs 3.01 through 3.08 must be considered a violation of the Contract itself and will be sufficient cause for halting the work without extending the time limit of the Contract.

3.10 COORDINATION OF CONSTRUCTION ACTIVITIES

- A. The Contractor must contact the Engineer and CDA each day before work begins to coordinate the status and nature of work to be done that day. The Contractor must also report to the Engineer and CDA at the end of each day to schedule the work planned for the following day.
- B. Violations of any coordination requirements will be considered a violation of the Contract itself and will be sufficient cause for halting the work without extending the time limit of the Contract.

3.11 SAFETY REQUIREMENTS

- A. Before entering upon or crossing any runway or taxiway, the Contractor will obtain permission from the Engineer and CDA, who will request the proper clearance through the CDA escort from the ATCT. Emergencies and operating conditions may necessitate sudden changes, both in Airport operations and in the operations of the Contractor. Aircraft operations must always have priority over any and all of the Contractor's operations. Should runways or taxiways be required for the use of aircraft and should Airport operations, the ATCT, or the Engineer and CDA deem the Contractor to be too close to active runways or taxiways the Contractor must suspend operations, remove personnel, plant, equipment, and materials to a safe distance and stand by until the runways and taxiways are no longer required for use by aircraft. There will be no compensation for delays or inefficiencies due to these changes.

- B. Throughout the duration of the job, any practice or situations that the Engineer and CDA determines to be unsafe or a hindrance to regular Airport operations will be immediately rectified.
- C. Any violation of these safety requirements will be considered a violation of the Contract itself and will be sufficient cause for halting the work without extending the time limit of the Contract.
- D. The Contractor must acquaint supervisors and employees with the operations that are inherent to Chicago O'Hare International Airport and must conduct construction activities to conform to all routine and emergency air traffic requirements and guidelines for safety specified herein. The Contractor will be responsible for providing all safety devices as required for the protection of personnel.
- E. Protection of all persons must be provided throughout the progress of the work. The work must proceed in such a manner as to provide safe conditions for all workers and personnel. The sequence of operations must be such that maximum protection is afforded to ensure that personnel and workers in the work area are not subject to any dangerous conditions. The Contractor must provide safety measures to guard against injury.
- F. During the performance of this Contract, the Airport facility must remain in use to the maximum extent possible. Use of areas near the Contractor's work will be controlled to minimize disturbance to the Airport's operation. The Contractor must not allow employees, Subcontractors, suppliers, or any other unauthorized person to enter or remain in any Airport area which would be hazardous to persons.
- G. All work to be performed which is too close to an active runway, taxiway or apron under operational conditions must be performed when the runway, taxiway or apron is not in use. Such work must not be accomplished without prior permission from the Engineer and CDA. Requested closings must be directed to the Engineer and CDA in writing at least 72 hours in advance. The Engineer and CDA will then notify the Contractor of the upcoming closure.
- H. The Contractor must be aware of the following types of safety problems and/or hazards. These problems or hazards will not be permitted. Should any of these problems or hazards arise during construction, the Contractor must immediately rectify/correct the problem or hazard to the satisfaction of the Engineer and CDA Personnel:
 - 1. Trenches, holes, or excavations on, adjacent to, or within 250 feet of the centerline of any active runway.
 - 2. Unmarked/unlighted holes or excavation in any apron, active taxiway, or within 107 feet of the centerline of any active taxiway.
 - 3. Mounds or piles of earth, construction materials, temporary structures, or other objects within 400 feet of the centerline of any active runway, or

within 160 feet of any active taxiway, or in a related safety, approach, or departure area.

4. Vehicles or equipment (whether operating or idle) on any active runway, taxiway, taxilane, or in any related safety, approach, or departure area.
5. Vehicles, equipment, excavations, stockpiles, or other materials which could degrade or otherwise interfere with electronic signals from radios or electronic navigational aids (NAVAIDS).
6. Runway paving projects resulting in excessive lips greater than 1 inch between abutting pavement edges and exceeding 3 inches between the edge of pavements and the infield.
7. Unmarked utility, NAVAID, weather service, runway lighting, or other power or signal cables that could be damaged during construction.
8. Objects (whether or not marked or flagged) or activities anywhere on or in the vicinity of the Airport which could be distracting, confusing, or alarming to pilots during aircraft operations.
9. Unflagged/unlighted low visibility items (such as tall cranes, drills, and the like) anywhere within the limits defined in Item 3, or in any approach or departure area.
10. Misleading or malfunctioning obstruction lights or unlighted/unmarked obstructions in an approach to any open runway.
11. Inadequate approach/departure surfaces needed to assure adequate landing/takeoff clearance over obstructions or work or storage areas.
12. Inadequate, confusing or misleading (to user pilots) marking/lighting of runways, taxiways, or taxilanes, including displaced or relocated thresholds.
13. Water, dirt, debris, or other transient accumulation which temporarily obscures pavement marking, pavement edges, or derogates visibility of runway/taxiway marking or lighting.
14. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of the AOA.
15. Trash or other materials with foreign object damage (FOD) potential, within the limits defined in Item 3.
16. Inadequate barricading or other marking which is placed to separate construction or maintenance areas from active aircraft operating areas.
17. Failure to control vehicle and human access to Airport Operations Area (AOA).
18. Failure to maintain radio communication between construction/maintenance vehicles and the ATCT, as coordinated with Chicago Department of Aviation Operations personnel.

19. Construction/maintenance activities or materials which could hamper the response of Aircraft Rescue and Firefighting (ARFF) equipment from reaching all aircraft or any part of the runway/taxiway system, runway approach and departure areas, and aircraft parking locations.
 20. Bird attractants on Airport, such as edibles (food scraps, etc.), miscellaneous trash, or ponded water.
- I. The Contractor must conduct activities so as not to violate any safety standards contained herein. The Contractor must inspect all construction and storage areas as often as necessary and promptly take all steps needed to prevent/remedy any unsafe or potentially unsafe conditions/activities discovered.
 - J. Before actual commencement of construction activity, the Contractor must notify in writing, at least seven (7) days in advance, the Engineer and CDA of his intentions to begin construction, stating the proposed time, date, and area in which commencement is to occur in order for the appropriate NOTAM to be issued.
 - K. Upon completion of work and return of all related areas to standard conditions, the Contractor must again notify the Engineer and CDA in writing, and describe the area that is complete and available for normal Airport operations.
 - L. Debris, waste and loose material or any other FOD (including dust and dirt) capable of causing damage to aircraft landing gear, propellers or being ingested in jet engines must not be allowed on active aircraft movement areas or adjacent infield areas. Materials observed to be within these areas must be removed immediately and/or continuously by the Contractor. The Contractor must be required to have an adequate number of sweeping machines and operators on site, ready at all times during construction activity. Where travel on or across runways, ramp areas, taxiways or aircraft aprons is required, the Contractor must provide adequate personnel and equipment to keep such surfaces clear of debris at the discretion of the Engineer and CDA. Closed pavements must be swept clean prior to reopening to aircraft traffic. Exposed earth in excavation areas adjacent to active taxiways must be covered to prevent dust from jet blast. Cover material must be weighted to prevent movement from jet blast.
 - M. Flagpersons. In accordance with the Specifications, the Contractor must furnish, at his or her own expense, flagpersons as necessary to control traffic unless otherwise directed by the Engineer and CDA.
 - N. Trenches, Excavations and Stockpiled Material. Open trenches or excavations exceeding 3" in depth and 3" in width will not be permitted within the limits defined in Paragraphs 3.11.H.1 and 3.11.H.2. Stockpiled material will not be permitted within the limits defined in Paragraph 3.11.H.3. Covering for open trenches or excavations must be of sufficient strength to support the weight of the heaviest aircraft operating on the runway or taxiway.
 - O. Construction in Proximity to Active Runways and Taxiways

1. Runway Sides. If appropriate construction/maintenance NOTAM has been issued, construction is permissible as close as 250 feet from the centerline of the active runway provided that all CDA and FAA criteria are met including FAA approval of the construction safety phasing plan. The 250 feet must be clearly marked in the infield areas with orange fabric as described in Paragraph 2.05.
 2. Runway Ends. No work will be permitted and no equipment or materials may be stored within 1,000 feet of the end of the active runway.
 3. Taxiway Sides. If appropriate construction/maintenance NOTAM has been issued, construction is permissible as close as the dimensions shown on the Construction Phasing Plans, provided that all CDA and FAA criteria are met including FAA approval of the construction safety phasing plan. This dimension(s) must be clearly marked in the infield areas with orange fabric as described in Paragraph 2.05.
- P. Equipment Height Restrictions
1. Maximum equipment height requirements are shown on the Construction Phasing Plans and must not be exceeded unless prior approval is obtained from the Engineer and CDA. Atop all equipment booms must be mounted the white and orange checkered flag described in Paragraph 3.04. The top ten feet (10') of these booms must be painted fluorescent orange and they must be equipped with a red obstruction light. Any crane erections must be coordinated with CDA Operations and the Engineer during every shift.
- Q. Miscellaneous
1. Open flame, welding or torch cutting operations are prohibited unless adequate fire and safety precautions have been taken and the procedure has been approved by the Engineer and CDA. Under no circumstances will flare pots be used.
 2. All materials and equipment when not in use must be placed in approved areas where they will not constitute a hazard to aircraft operations and not penetrate clearance height restrictions as shown on the Construction Phasing Plan(s). All equipment must be parked in the appropriate area(s) when not in use.
 3. The Contractor must provide the Engineer and CDA with a current list of all employees working on the Airport. The list must be maintained current by the Contractor and Subcontractors.
 4. Except for emergencies, all contact with Airport personnel must be made through the Engineer and CDA. For emergencies involving safety (injuries, fires, security breaches, etc.), the Contractor will make direct contact with the CDA followed by notification to the Engineer and CDA as soon as possible.

3.12 HAZARD MARKINGS

- A. Hazard-marking barricades, traffic cones, red flashers, etc. should be used to identify and define the limits of construction making them visible to aircraft, personnel, or vehicles; to identify hazards such as open manholes, small areas under repair, stockpiled material, waste areas, etc.; to prevent aircraft from taxiing onto a closed runway for takeoff; and to identify FAA, Airport, and National Weather Service facilities, cables, power lines, instrument landing system (ILS) critical areas, and other sensitive areas to prevent damage, interference, and facility shutdown. The Contractor must have a designated person on call 24 hours a day for emergency maintenance of Airport hazard lighting and barricades.

3.13 CONSTRUCTION AREA MARKING AND LIGHTING

- A. Low profile lights, retroreflective taxiway edge markers, low level barriers, and warning flags must be provided and erected by the Contractor as shown on the Plans or as directed by the Engineer and CDA. All construction areas should be clearly and visibly separated from active air operation areas. Hazard areas, facilities, cables, and power lines should also be clearly identified by the Contractor. The Contractor is responsible for maintaining the condition and visibility of all markers identifying above-mentioned areas and that marking and lighting aids remain in place. Approved barricades, traffic cones, omnidirectional red flashers, and/or signs should be used as necessary to clearly separate all construction/maintenance areas from other parts of the AOA. All barricades, temporary markers, flaglines supports, and other objects placed and left on or in the vicinity of any open runway, taxiway, or taxilane should be: as low as possible to the ground; of low mass; easily collapsible upon contact with an aircraft or any of its components; weighted down or sturdily attached to the surface to prevent displacement from propwash, jet blast, wing vortex, or other surface wind currents; and if affixed to the surface, frangible at ground level.

3.14 CONSTRUCTION NEAR NAVIGATIONAL AIDS

- A. Construction materials and equipment must not be placed or parked where they may interfere with the line-of-sight of the ATCT and navigational aids in operation. The Engineer and CDA will determine if any materials or equipment will cause any type of interference.

3.15 CONSTRUCTION SITE ACCESS AND HAUL ROADS

- A. The Contractor will not be permitted to use any access or haul roads other than those designated on the Contractor's approved construction phasing plan. The Contractor will submit specific proposed ingress and egress routes associated with specific construction activities to the Engineer and CDA for evaluation and approval prior to commencing construction activities. Aircraft Rescue and Firefighting (ARFF) right-of-way on access roads, haul roads, taxiways, and runways will not be impeded at any time.

3.16 CONSTRUCTION MATERIALS STOCKPILING AND EQUIPMENT STORAGE

- A. Stockpiling of construction materials and equipment storage is not permitted within 400 feet of the runway centerline and 160 feet of the taxiway centerline. Stockpiled materials and equipment should be prominently marked with red flags and lighted during hours of restricted visibility or darkness if in the air operations area. Stockpiled material or equipment should not be stored near aircraft turning areas or operational movement areas, aprons, or excavations and trenches. Stockpiled materials must not be stored near NAVAIDs, visual or approach aids, nor will they obstruct the ATCT's line of sight to any runway or taxiway. The Contractor must ensure that stockpiled construction materials and equipment do not cause degraded or hazardous conditions to Airport safety. This includes determining and verifying that stockpiled materials and equipment are stored or parked at an approved location, that they are properly stowed to prevent foreign object debris (FOD), attraction by wildlife, or obstruction of air operations either by their proximity to NAVAIDs or to aircraft movement areas.

3.17 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT

- A. Waste and loose materials capable of causing damage to aircraft landing gears or propellers, or capable of being ingested in jet engines must not be left or placed on or near active aircraft movement areas. Materials tracked onto these areas must be continuously removed during the construction Project. Waste or loose materials which would attract wildlife must be carefully controlled and removed on a continuous basis.

3.18 RUNWAYS AND TAXIWAYS

- A. Nothing must be placed upon runways, taxiways, taxilanes, or aprons without written authorization from the Engineer and CDA.

3.19 INSTALLATION OF TEMPORARY SAFETY AREA MARKING

- A. Installation of the safety area fence must conform to the following:
 1. The fence must be installed on the existing grade along the edge the safety area (RSA and TSA) as determined by field survey.
 2. Posts/stakes must be set plumb, and in good line on the side on which the fabric is to be fastened. Posts/stakes must be set full depth and must not be cut off to eliminate rock or other excavation. Where rock is encountered, it must be removed. The posts/stakes adjacent to ends, corners, or anchors must be braced. Posts/stakes should be driven 18 inches into the ground and be spaced at 4 feet maximum.
 3. The top edge of the fabric must be affixed to within 1 inch of the top of each post/stake leaving a nominal 6 inch clearance between the ground surface and the bottom edge of the fabric.
 4. A minimum of four evenly spaced staples per post must be used to affix the fabric. Where joints are necessary, each end of the fabric must be

securely fastened to a post and those posts be placed adjacent to each other or wrapped around each other similar to a silt fence.

3.20 INSTALLATION OF TEMPORARY UNDERGROUND UTILITY MARKING

- A. For FAA underground utilities including ducts, cables, and structures, the Contractor must provide, install, and maintain 2" PVC posts with light blue colored labels identifying FAA along the center and over the utility, at 25 feet intervals for the entire work zone except inside the 250' Runway Safety Area (RSA) or 160' Taxiway Object Free Area (OFA), where marking paint on the ground only must be used to mark utilities. In areas where the FAA utility will be exposed, the Contractor must provide, install, and maintain two lines of similarly marked 2" PVC posts at 5 feet offsets each side of the FAA utility centerline at 25 feet intervals. Post markers must also be installed at all points where the FAA line changes direction.
- B. For all other underground utilities (electrical and ComEd ductbanks and cables, telephone and communication lines, gas mains, watermains, sewer pipes, fuel lines, etc.), the Contractor must provide, install and maintain 2" PVC posts with APWA colored labels identifying the specific utility type along the center and over the utility, at 25 feet intervals for the entire work zone except inside the 250' RSA or 160' Taxiway OFA, where marking paint on the ground only must be used to mark utilities.
- C. Labels for 2" PVC pipe must be self-adhesive vinyl labels, with high visibility APWA color coded per the detail provided by the Engineer and CDA, a minimum 12 inches long by 7.5 to 7.75 inches wide, with 1.75 inches lettering with the words "GAS, POWER, FAA, PHONE, WATER, CED, FIBER, OR STORM/SAN" as required.
- D. Provide labels from the following manufacturers (or equal):
 - 1. Mainstreet Lettering – 5659 Box Elder Road, Marshall, WI 53559, 608-655-4757.
 - 2. Uline – Custom Dept. 2105 South Lakeside Drive, Waukegan, IL 60085, 800-295-5510 Ext. 5099.
- E. The PVC posts must be a minimum of 5 feet in overall length. The exposed post height must be at least 4 feet and embedment to a depth necessary to keep the post vertical and stable. Maintenance of posts and/or replacement of any damaged posts will be at the Contractor's cost.

3.21 PROTECTION AND SUPPORTS FOR UNDERGROUND UTILITIES

- A. The Contractor must provide adequate provisions to protect all underground utilities and structures exposed during the proposed work or being crossed by access roads, new sewer lines, new electrical ducts, new drainage lines and haul roads.
- B. The Contractor must submit a plan and design indicating the size, type and configuration of the materials to be used in supporting the underground utilities and structures that will be exposed. Drawings showing how the utility

Added 1/8/2013

lines/structures will be protected must be provided in advance by the Contractor for approval by the Utility Owner before installation. The Contractor must provide the identity of the registered Professional Engineer approving the design prior to the work. At least one copy of the stamped/approved design must be maintained at the jobsite while the support is being constructed. The Contractor is responsible for all associated costs to acquire approved design, materials and the construction of the utility supports.

- C. The Contractor will be responsible for notifying the Utility Owner at the Project pre-construction meeting should utility relocation become necessary (for FAA cable relocation, notify the FAA Technical Operations).
- D. All excavating within 5 feet on either side of existing underground utilities and infrastructures is to be performed by hand. The Contractor will be responsible for locating and hand digging to locate the utility lines and structures.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 MEASUREMENT AND PAYMENT

- A. Airport safety and security will not be paid for separately, but will be considered included in all other items of work for the FAA relocations included in these Specifications. Airport safety and security will include furnishing all materials and equipment, including but not limited to flagpersons, guards assigned outside the AOA, escort vehicles and operators, sweepers, temporary gates, warning markers, safety area markings, underground utility markings, protection and supports for underground utilities, medium and low level barriers, other traffic control devices and necessary equipment, and other materials and equipment listed herein, and the maintenance thereof and all other labor, materials, equipment, tools, and all work necessary to accomplish this item. All required items shall be identified as separate line items in the Contractor's proposed Construction Progress Schedule. Additional compensation or the extension of contract time will not be allowed for the progress of work items affected by the lack of such coordination by the Contractor.

MALSR MODIFICATIONS AND FOUNDATIONS (SECTION 13100)

PART 5 DESCRIPTION

5.01 SECTION INCLUDES

- A. Work under this section is subject to the requirements of the Contract Documents.
- B. Furnish and install all work associated with the proposed MALSR modifications as shown on the Drawings and as specified herein. This work must include, but not be limited to the following:
 - 1. Removal and disposal of existing MALS tower, foundations, and associated conduits
 - 2. Removal and disposal of existing conductors between existing MALSR distribution panel and MALS station
 - 3. Removal and disposal of existing handhole and conduits feeding existing MALS station
 - 4. Installation of new MALS foundation, tower, and light fixtures
 - 5. Installation of new conductors between existing MALSR distribution panel and proposed MALS station
- C. See special provision FAA Specification Sections (Section 13650) for reference FAA specification sections.

5.02 RELATED WORK

- A. As specified in the following special provisions:
 - 1. MALSR Electrical (Section 16620)
 - 2. Installation of Underground Cable for Airports (Section L-108)
 - 3. Installation of Airport Underground Electrical Duct (Section L-110)
 - 4. Electrical Manholes and Handholes for FAA Relocations (Section L-115)
 - 5. Site Demolition for FAA Relocations (Section X-100)

5.03 REFERENCES

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.03.
- B. See special provision FAA Specification Sections (Section 13650) for reference of FAA specification sections.

5.04 SUBMITTALS

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.04.

B. Shop Drawings

1. Shop Drawings must show all materials, method of joining, sizes of members, and thickness of metal, and must contain full and complete information regarding joints and fastenings. All items must be plainly marked for location on the job site.

C. Erection Diagrams

1. Erection diagrams must clearly indicate the method and sequence of erection, item mark numbers, equipment loads and calculations indicating the adequacy of the permanent construction to sustain equipment and construction loads and required tolerance for setting embedded items.
2. Parts must be marked in the same manner as in the shop drawings.

D. Test Reports

1. Submit test reports necessary to show compliance with the Contract Documents.

E. Manufacturer's Certification

1. Submit certification that products meet or exceed the specified requirements.
2. Certification of Welders.

5.05 QUALITY ASSURANCE

- A. See specification section 16010, part 1.05.

5.06 DELIVERY STORAGE AND HANDLING

- A. Under this contract a new MALSR light tower with new light fixtures will be installed. Contractor will be responsible for the new tower and light fixtures until the re-commissioning of the MALSR system by the FAA.

5.07 WARRANTIES AND GUARANTEES

- A. See specification section 16010, part 1.07.

5.08 EXTRA MATERIALS AND SPARE PARTS

- A. Two spare "A" tubes for proposed MALS LIR tower, as stated on drawings.

5.09 ENVIRONMENTAL REQUIREMENTS

- A. None required

5.10 SPECIAL REQUIREMENTS

- A. Field Measurements - Before proceeding with the fabrication of the Work, the

Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.

- B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.

PART 6 PRODUCTS

6.01 MALSR ELECTRICAL ITEMS

- A. See specification section 16620 for construction of the following items:

1. General electrical items
2. MALSR Light Fixtures and Lamps
3. Power Distribution Equipment
4. Grounding
5. Conduit, Enclosures, Wireways
6. Wire and Cable
7. Electrical Identification

6.02 MALSR FOUNDATIONS

- A. New MALSR foundations must be installed as indicated on the Plans, and as indicated on the reviewed erection diagrams.

6.03 MALSR TOWERS

- A. MALS tower structures must be constructed as indicated on the Plans and on reviewed shop drawings.

PART 7 EXECUTION

7.01 DEMOLITION AND REMOVAL

- A. Existing MALS tower to be removed must be turned over to the FAA, or disposed of as directed by the Engineer and FAA.
- B. See specification section X-100 for demolition and disposal of existing foundations, structures, and ductbanks.

7.02 MALSR FOUNDATIONS

- A. New MALSR foundations must be installed at the location indicated on the plans. The center of the LIR tube must be exactly on the runway centerline extended and exactly at the station indicated on the Plans.
- B. New MALSR foundations must be installed as indicated on the Plans, and as indicated on the reviewed erection diagrams.

7.03 DUCTBANKS AND HANDHOLES

- A. Ductbanks must be constructed as defined in specification section L-110, and as indicated on the plans.

- B. Handholes must be constructed as defined in specification section L-115, and as indicated on the plans.

7.04 MALSR TOWERS

- A. New MALSR towers must be installed as indicated on the Plans, per specification section 13650-13A, and as indicated on the reviewed erection diagrams.

7.05 MALSR LIGHT FIXTURES

- A. MALSR light fixtures must be installed as indicated on the plans.

7.06 MALSR POWER CABLES

- A. MALSR power cables must be installed in accordance with specification section L-108.

7.07 MALSR TESTING

- A. The newly installed MALSR assembly must be operationally tested in accordance with section 13650, Appendix section 13A.4. The Contractor must coordinate Flight Check of the MALSR assembly with the Engineer, CDA, and FAA.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

- A. Measurement will be made for each MALS tower to be installed. Measurement will include removal and disposal of the existing foundation, conduits, and tower, installation of the new foundation, base can, lid, LIR tower, fixtures, transformer, lamps, cabling, conduit, above ground cable, splices, identification, lubricant, terminations, testing, aiming, site restoration, and all other items associated with the full installation of the light tower per the plans and specifications.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

- A. Payment will be made at the contract unit price for each for INSTALL NEW MALSR MG-30 LIGHT TOWER – COMPLETE tower to be installed and will include removal and disposal of the existing foundation, conduits, and tower, installation of the new foundation, base can, lid, LIR tower, fixtures, transformer, lamps, cabling, conduit, above ground cable, splices, identification, lubricant, terminations, testing, aiming, site restoration. This price includes full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

FAA SPECIFICATION SECTIONS (SECTION 13650)

PART 1 DESCRIPTION

1.01 SECTION INCLUDES

- A. Work under this section is subject to the requirements of the Contract Documents.
- B. This specification section is designed as a central location for the applicable FAA specifications so that multiple contract specification may reference the same FAA specification. No specific pay item or work is associated with this section; however the Contractor is expected to be familiar with the attached specifications and apply sections as necessary.

1.02 RELATED WORK

- A. As specified in the following special provisions:
 - 1. MALSR Modifications and Foundations (Section 13100)
 - 2. Basic Electrical Requirements for FAA Relocations (Section 16010)
 - 3. MALSR Electrical (Section 16620)
 - 4. Installation of Underground Cable for Airports (Section L-108)
 - 5. Installation of Airport Underground Electrical Duct (Section L-110)

1.03 REFERENCES

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.03.

1.04 SUBMITTALS

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.04.
- B. Contractor must coordinate with Engineer, CDA, and FAA to include the FAA in the shop drawing review process.
- C. Shop Drawings must show all materials, method of joining, sizes of members, and thickness of members, and must contain full and complete information regarding joints and fastenings. All items must be plainly marked for location on the job site.
- D. Contractor must submit test reports as necessary to show compliance with the Contract Documents.
- E. Upon request contractor must submit manufacturer's certification that products meet or exceed the specified requirements.

1.05 QUALITY ASSURANCE

- A. Contractor will do quality control, Engineer will do quality assurance.

- B. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.05.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.06.

1.07 WARRANTIES AND GUARANTEES

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.07.

1.08 EXTRA MATERIALS AND SPARE PARTS

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.08.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. None required

1.10 SPECIAL REQUIREMENTS

- A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.
- B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.

PART 2 PRODUCTS

2.01 FAA NAVAID FACILITIES AND EQUIPMENT

- A. As referenced in other specification sections and as detailed in the attached FAA specification sections.
- B. Note – all references to screw anchor foundations in the attached FAA specification sections must be ignored. No device may be installed on a screw anchor at O'Hare, even for a temporary installation. Reinforced concrete foundations must be used.

PART 3 EXECUTION

3.01 FAA NAVAID FACILITIES AND EQUIPMENT

- A. As referenced in other specification sections and as detailed in the attached FAA specification sections.
- B. See plan sheets for construction of concrete foundations in lieu of screw anchors.

PART 4 METHOD OF MEASUREMENT

4.01 No items are measured under this section

PART 5 BASIS OF PAYMENT

5.01 No Payment will be made under this section

APPENDIX

Department of Transportation
Federal Aviation Administration
Great Lakes Region

Summary

This appendix includes copies of standard FAA, Great Lakes Region, specifications that are made available to the Contractor as a convenience for informational purposes. Contractor must ensure that the latest revision of the supplement is obtained from the FAA, through the Engineer, CDA, and FAA, before submitting shop drawings that will be reviewed by the FAA.

Attached Documents

FAA-GL-918C, Specification for Construction of Terminal Navigation Facilities
Department of Transportation, Federal Aviation Administration, Great Lakes Region
dated November 30, 1994

Section 13A – Approach Light Systems

Section 16A – Basic Methods and Materials

Section 16B – 600 Volt Power Cable for Underground Installation

Section 16E – Control Cable

Section 16F – Cable Installation

Specifications Supplemental to Specifications FAA-GL-840b and FAA-GL-918C
Department of Transportation, Federal Aviation Administration, Great Lakes Region
dated October 28, 2003

DIVISION 13 - SPECIAL CONSTRUCTION SECTION 13A APPROACH LIGHT SYSTEMS

13A.1 DESCRIPTION OF WORK. This section is applicable for construction required for a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) and other approach lighting systems utilizing similar construction.

13A.2 INSTALLATION OF MALSR LIGHTS.

- a. Screw Anchor Foundations. Comply with Section 13D and project drawings if screw anchor foundations are required on the drawings.
- b. Installation Tolerances. Installation tolerances for the various types of light bars and flasher units shall be as follows:
 - (1) Longitudinal (along the runway centerline) + 6 inches deviation from design station.
 - (2) Lateral (perpendicular to the runway centerline). ± 3 inches
 - (3) Horizontal distance between individual frangible lights. ± 1 inch
 - (4) Mounting height.
 - (a) Up to 6 feet. ± 1 inch
 - (b) 6 to 40 feet. ± 2 inches
 - (c) Over 40 feet. ± 3 inches
 - (5) All lights in a frangible bar shall be installed within ± 1 inch of a line perpendicular to the runway centerline.
- c. Assembly of PAR-56 Lights. If installation of PAR-56 lights is included in the contract, the contractor shall assemble the PAR-56 lampholders, lamps, and, if included, filter-holding clips, colored glass filters, and (for ALSF-2 facilities) shorting devices, into complete units, from unassembled condition. Use the spring-loaded lamp-retaining hardware supplied with the lampholders.
- d. Frangible EMT Mountings.
 - (1) Frangible Coupling Installation. Each frangible coupling has a hexagonal throat with a break-off groove in the middle, designed to break at low impact, thereby minimizing damage to colliding aircraft. When installing the frangible coupling, take care to use a

13A.2d(1)

wrench which will grip only the lower portion of the hexagonal throat of the coupling, i.e., that portion immediately below the break-off groove. If the

wrench grips the upper portion of the hexagonal throat, the coupling may break when torque is applied. See Paragraph 16A.20 for thread remediation. Whether thread remediation is performed or not, the contractor shall apply anti-seize compound to the threads of the frangible coupling, and to the internal threads of the receiving coupling or hole, to facilitate removal. The compound shall be an anti-seize assembly lubricant formulated to provide protection for stainless steel and dissimilar metal threaded fasteners against galling, seizure, and heat-freeze. Do not use plumber's pipe-joint compound. The frangible coupling shall be screwed down tightly into the conduit coupling or light base cover plate threaded hole, to prevent the EMT mounting from turning.

- (2) Cable Connectors. Where cable connectors are required within the frangible couplings, the connectors shall have the capability of separating easily upon breakage of the frangible couplings. Therefore, apply silicone grease of high dielectric strength to the mating surfaces of the plug and receptacle connectors. Do not allow the silicone grease to make contact with the plug and receptacle terminals, and do not place electrical tape over the connector joints. A cable clamp or cable connector clamp shall firmly grip the receptacle connector of the lower cable assembly (never the plug connector of the upper cable assembly). The connectors shall be vertically positioned such that the joint between the two connectors is as close as feasible to the breakoff groove. If the receptacle cable connector is the 1"-diameter style (e.g., 90R-B6), the connector shall be gripped by an aluminum split-ring cable clamp. The Multi Electric Part No. 961-X cable clamp is among the clamps which meet this specification. If the receptacle cable connector of the style having a 1.75-inch-diameter donut for use in a light base (such as on the secondary lead of isolation transformers), the connector shall be gripped by the cable connector clamp which comes with the base plate.
- (3) Upper Cable Assembly. Sufficient slack shall be left in the upper cable assembly at the point of entering the lampholder to permit:
 - (a) Removal of the lampholder.
 - (b) Disconnection of the cable connectors in the frangible coupling without disturbing connections to the lampholder.

13A.2e

- e. Plumbness Tolerance for EMT Frangible Light Masts. EMT frangible light masts shall be installed to a plumbness tolerance of 1/16-inch per foot of mast height. This requirement is in addition to all other placement tolerances. If the mast foundation is concrete, the plumbness tolerance shall be met by proper placement of the concrete-embedded section of conduit, not by bending the mast. To insure plumbness, temporary rigid conduit masts shall be threaded into the conduit couplings, and clamped in place in a rigid brace during concrete placement, finishing, and setting. If the masts are to rise from a steel channel attached to a screw anchor foundation, the plumbness tolerance shall be met by proper attachment of the conduit couplings to the channel, not by bending the masts. In this case, temporary rigid conduit masts shall be threaded into the conduit couplings, and clamped in place in a rigid brace during the welding of the couplings to the channel.

- f. Fiberglass LIR Approach Lighting Towers. LIR means Low Impact Resistance. An LIR tower is a tower designed to disintegrate when struck by an aircraft, offering low impact resistance to the aircraft, thus minimizing aircraft damage. The fiberglass LIR towers, if required by the drawings, shall be assembled from knocked-down (unassembled) condition according to the manufacturer's assembly instructions. Install the towers on foundations constructed in accordance with the drawings. On drawings, for brevity, fiberglass LIR towers are sometimes also called masts and poles.
- g. Aiming and Alignment of Lights. Each light shall be adjusted so that its optical axis is parallel to the runway centerline, directed outward from the runway threshold, and aimed upward to the required vertical angle. An aiming device is furnished for vertical aiming of the PAR-56 and the PAR-38 lampholders and flashing light units.

13A.3 MALSR BRIGHTNESS. The contractor shall adjust the MALSR to operate as follows:

<u>Step</u>	<u>% Relative Intensity</u>	
	<u>MALS</u>	<u>RAIL</u>
High Intensity	100	100
Medium Intensity	20	8
Low Intensity	4	1

13A.4 OPERATIONAL TESTS. The contractor shall demonstrate, by operational tests, that the entire system will operate satisfactorily. If the contract requires the establishment of remote control, satisfactory system operation shall be demonstrated on remote and local control. If the contract does not require the establishment of remote control, satisfactory system operation shall be demonstrated on local control

13A.4

only. The test shall demonstrate that the system meets all requirements of this specification and of the manufacturer's instruction manual.

13A.5 MALS LAMPS. If MALS lamps are not shown on the Government-Furnished Property List, the contractor shall furnish ninety (90) PAR-38, 120-watt spot lamps. The photometric performance of these lamps shall equal or exceed the vertical and horizontal brightness beam spread candela values shown on Figure L at the end of this section. The Figure L beam spread curves were approximately reproduced from the July 1983 FAA

Technical Center data report on photometric tests of MALS PAR-38 spotlights. The lamps must also be physically shaped to fit the PAR-38 lamp aiming device supplied as part of the MALSR equipment from the MALSR manufacturer. The General Electric PAR-38 120V, 120W, Wattmiser spot lamp (GE Designation 150 PAR/SP/120/WM) is one of the products which meet these specifications. If the contractor intends to furnish a substitute lamp, the contractor shall submit to the Contracting Officer, complete manufacturer's information, including vertical and horizontal brightness beam spread candela values, and a sample lamp, to demonstrate that the lamp will fit the MALSR manufacturer's PAR-38 lamp aiming device. See Paragraph 1A.4 above. The contractor shall install the required number of these lamps on the MALS structures. The remaining lamps shall be delivered to the Resident Engineer as spares.

13A.6 MALSR CABLE SPLICES.

- a. Restrictions. The only underground MALS R cable splices which will be permitted under this contract will be the splices shown on the drawings. The contractor shall inventory the reels of Government-furnished cable and contractor-furnished cable, to verify that sufficient continuous lengths are available to preclude any other splices. If the contractor discovers that insufficient continuous lengths are furnished, he shall report this condition to the Resident Engineer immediately.
- b. Mold and Compound. Every 600-volt power cable splice shall be made with a flexible film plastic mold with a built-in spacer web to provide cable and connector centering, and proper coverage by the insulating and sealing compound. The applied mold shall be filled with a flexible polyurethane electrical insulating and sealing compound capable of continuous operation at 90°C, with an emergency overload temperature rating of 130°C. The splices shall be rated for direct burial applications. The splicing kits shall be sized properly to the application. Splicing kits of the 3M Scotchcast 85 series are among products which meet these specifications. If kits of this series are selected, splices at the threshold bar, at EMT light bars, and at

13A.6b

5-tower bars, shall be made with 85-16 kits, unless specified otherwise. Splices at the MALS T-bar towers shall be made with kits no smaller than 85-12, unless specified otherwise. Substitute splicing kits require submittals per Paragraph 1A.4 above.

- c. Connectors. Connectors used in the splices shall be compact compression tap connectors properly sized to the application. The connectors shall be copper, except aluminum connectors are permitted if they are designed for use with copper conductors. The contractor shall furnish and use the proper crimping tools and dies for the connectors, and shall execute the number of crimps required by the manufacturer. Mechanical (bolted) tap connectors shall not be used in splices below grade. The following connectors, primarily for underground splices at MALS bars, are approved, as they are among the products which meet these specifications (substitutes require submittals per Paragraph 1A.4 above):

- (1) The following Burndy Crimpit Type YC-C compression connectors:

<u>Cat. No.</u>	<u>Run</u>	<u>Tap</u>
YC10C10		#10 AWG
YC8C8		#8 AWG
YC26C2		#2/0 AWG
YPC26R8U		#2/0 AWG

- (2) For #2, #4, or #6 run cable to #10 tap cable, Burndy street lighting tap, Catalog Number YPC2A8U.

13A.7 MALS POWER DISTRIBUTION PANEL CIRCUIT DIRECTORY. The contractor shall mark the MALS power distribution panel circuit directory, identifying each branch circuit breaker by the MALS bar station(s), each breaker serves. Spare breakers shall be so identified.

DIVISION 16 - ELECTRICAL

SECTION 16A

BASIC METHODS AND MATERIALS

16A.1 APPLICABLE DOCUMENTS.

- a. Federal Documents. The following Federal Specifications in effect on the date of the invitation for bids or request for proposals, form a part of this specification.
 - (1) WW-C-581 Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit:
Zinc-Coated
 - (2) WW-C-563 Conduit, Metal Rigid; Electrical, Thinwall Steel Type (Electrical Metallic Tubing); Straight Lengths, Elbows, and Bends
 - (3) W-F-408 Fittings for Conduit, Metal, Rigid (Thickwall) and Thin-Wall (EMT)
- b. Electrical Codes. The following publications and regulations, in effect on date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.
 - (1) NFPA Number 70 National Electrical Code.
 - (2) The rules and regulations of local utility companies providing service.
 - (3) Local governing body rules and regulations.

16A.2 REQUIREMENTS.

- a. General. The contractor shall install all electrical work in accordance with the applicable drawings and specifications. All electrical work shall be installed to

meet the provisions of the current issue of the National Electrical Code, NFPA-70, and all state and local regulations.

b. Contract Drawings.

- (1) Where the electrical drawings indicate or (diagrammatically or otherwise) the work intended and the functions to be performed (even though some minor details are not shown), the contractor shall furnish all equipment, material (other than Government-furnished items) and labor to complete the installation work, and accomplish all the indicated functions of the electrical installation.
- (2) Minor departures from exact dimensions shown on the drawings may be permitted where required to avoid conflict or unnecessary difficulty in placement of the dimensioned item, provided all other contract requirements are met. The contractor shall promptly obtain approval from the FAA Resident Engineer for any such proposed departure.

- c. Materials. Materials and equipment, to be acceptable, must comply with all contract requirements. Materials to be furnished by the contractor under this specification shall be new and, unless specified otherwise, the standard products of a manufacturer's latest designs. Wherever standards have been established by Underwriters' Laboratories, Inc., the materials shall bear the UL label.

16A.3 CONDUIT.

- a. Where electrical metallic tubing is shown on the drawings, at exterior or interior locations, it shall be used without substitution.
- b. Except where specified otherwise, conduit exposed to the weather, in concrete, or below grade shall be galvanized rigid steel with threaded joints. All conduit and conduit fittings in contact with earth shall be field coated with asphaltum or have a factory PVC coating.
- c. Except where otherwise specified, conduit used entirely indoors shall be rigid or electrical metallic tubing. Compression type fittings shall be used with metallic tubing.
- d. Minimum size of conduit shall be 3/4-inch unless otherwise noted on the drawings. Each conduit run shall be installed complete before cable is pulled through.
- e. All outdoor connections of conduit to enclosures shall be made with weatherproof hub fittings unless otherwise specified. Indoor connections of rigid conduit to enclosures shall be made with double locknuts and bushings. Refer to grounding section for disconnect switch conduit terminations.

16A.3f

- f. Ends of conduits installed but not used, shall be closed with bushings and pennies. All underground conduit shall be temporarily plugged during construction to prevent entrance of foreign material.

- g. Wherever conduit from outdoors or underground enters an enclosure or junction box, either indoors or outdoors, seal space between conduit and cables with conduit seal.
- h. Exposed conduit shall be installed parallel to or at right angles with equipment and building wall surfaces unless shown otherwise. Field bends shall be avoided where possible, and where necessary shall be made with a hickey or conduit-bending device. Radius of field bends shall not be less than ten times the inside diameter of the conduit. Conduit shall be fastened securely to adjacent members or surfaces with galvanized clamps, straps.
- i. The contractor shall install one #6 copper pull wire in underground duct or conduit which is installed or utilized under this contract. This is in addition to all power or control cables installed under this contract. The pull wire shall be continuous through the duct or conduit, and shall extend five feet beyond each end of the duct or conduit.
- j. Flexible conduit shall be installed where specified on the drawings.

16A.4 GROUNDING.

- a. Equipment, Structures, and Raceways.
 - (1) All metallic non-current carrying parts of electrical equipment (including enclosures) and supporting structures installed under this contract, whether used either for power or control, shall be grounded with an equipment grounding conductor, whether or not shown on the drawings. The grounding conductor shall be sized in accordance with the National Electrical Code, but shall be of larger gauge if so shown on the drawings. In no case shall the grounding conductor be smaller than #12 AWG, unless shown otherwise on the drawings.
 - (2) A service entrance conduit or any other power feeder conduit emerging from below grade and supplying power to another facility or system component shall terminate with grounding bushings at both ends. These requirements apply unless shown otherwise on the drawings.
 - (3) The equipment grounding conductor shall be connected to the grounded conductor (neutral) only at the service entrance disconnecting means. The equipment grounding conductor shall be installed in the same conduit as its related branch and feeder conductors, and shall be connected to the ground bus in the branch or distribution panelboard. The equipment grounding conductor shall be connected to all grounding bushings on conduits through which the conductor passes. The equipment grounding conductor shall be connected to all other grounding conductors in enclosures and bodies through which the conductor passes.
 - (4) Where there are parallel feeders installed in more than one raceway, a properly sized equipment grounding conductor shall be installed in each raceway. The metallic conduit carrying the equipment grounding conductor shall be electrically continuous, forming a path parallel to the equipment grounding conductor. Under no circumstances shall the equipment grounding conductor be omitted from the electrical system. Nor shall any separate grounding system such as the signal ground, be used for an

alternate grounding system or and alternate path to the grounding electrode, unless so shown on the drawings.

- (5) All connections to the equipment to be grounded shall be made with a grounding connector specifically intended for that purpose. Connecting screws or mounting bolts and screws are not suitable for use as grounding connections. All ground lugs shall be of a non-corroding material suitable for use as a grounding connection, and must be compatible with the type of metal being grounded. **REMOVE PAINT AND OTHER NON-CONDUCTING MATERIALS FROM SURFACES OF GROUNDING CONNECTIONS.**
 - (6) Unless otherwise specified, control equipment enclosures, pull boxes, and raceways, shall be grounded as above for power wiring.
 - (7) Where surface-mounted square duct, other wireways, or cable tray systems are installed, a separate copper conductor shall be installed in the raceway, and shall be properly bonded to each section. Unless otherwise specified, the minimum size ground conductor shall be #6 green insulated copper.
- b. Service Entrance Disconnect Switches and Breakers. All facility service entrance disconnect switches and breakers shall be grounded as follows:
- (1) The neutral bar or lug shall be grounded with a green insulated copper grounding electrode conductor, running directly to the grounding electrode. The grounding electrode conductor size shall be in accordance with the NEC, but in no case shall the wire size be smaller than No. 4 AWG.
 - (2) The switch box or panelboard enclosure shall be grounded to the grounded neutral bar or lug with a green insulated conductor, or other service grounding means.
- c. Grounding Electrode. Grounding electrodes (rods) shall be copper clad steel, 3/4-inch by 10 feet, except where otherwise specified. The top of the grounding electrode shall be a minimum of 12 inches below finished grade. Lightning down conductors shall be attached to electrodes with exothermic welds only. Shelter perimeter grounding conductors shall be attached to electrodes with exothermic welds only, except in grounding access wells. In a grounding access well, grounding conductors shall be attached with bolted mechanical connectors. Other grounding conductor(s) shall be attached to the electrode with an exothermic weld or by hydraulically crimped compression connectors, as specified below.
- d. Grounding Conductor. All grounding conductors shall be copper. All grounding conductors which are totally above grade shall be green-insulated conductors. All grounding conductors which are either entirely or partially direct-earth buried, shall be #6 AWG bare conductors, unless noted otherwise on the drawings.
- e. Buried Guard Wire. Underground cables which are not completely enclosed in ferrous metal conduit, shall be protected by a #6 AWG bare solid copper guard wire. The guard wire shall be embedded in the soil 10 inches directly above, and parallel to, the highest of the cables in the trench or duct system. The guard wire shall be bonded to the grounding electrode system at each end of the cable run, and to grounding electrodes along the cable run at intervals not exceeding 300 feet. The guard wire

shall be connected to the electrodes with exothermic welds, or by hydraulic crimping, as specified below.

- f. Exothermic Process for Connecting Grounding Conductors to Metal Objects. Where the drawings and/or specifications require connection of a grounding conductor to a metal object by exothermic process, the contractor shall supply the correct exothermic welding kit for the application. The mold and cartridge used shall be selected on the basis of size, number, and type of conductors to be connected, composition and surface shape of object, and position in which the weld will be made. Two sources of exothermic welding kits are Thermoweld (Continental Industries) and Cadweld (Erico Products, Inc.). Some of the kits are listed on the tabulation at the end of this section. Regardless of the source of the kits he selects, the contractor shall submit catalog cuts or other manufacturer information, demonstrating that the kits fit their intended applications on the above described basis. See Paragraph 1A.4 above. The contractor shall provide and use the proper preparation tools in applying the exothermic process to insure an adequate weld. Torch welds and/or brazing will not be permitted. No single-use exothermic weld molds, such as Thermoweld "Single Shot" and Cadweld "One Shot", will be permitted.
- g. Hydraulically Crimped Connections. Grounding conductors (except lightning down conductors, shelter perimeter grounding conductors, and conductors inside a grounding access well) may be connected to grounding electrodes with compression connectors crimped with a force of at least 24,000 pounds. All grounding conductors (except shelter lightning protection system conductors) may be connected to each other with compression connectors crimped with a force of at least 24,000 pounds. Connectors, tools, dies, and crimping procedures shall be compatible to the application and to each other, and shall conform to the manufacturer's catalog and instructions. Each connector shall be clearly marked with catalog number, conductor size, and installation die information. The tooling shall be of the type that embosses or engraves the die index number on the connector in the crimping process. All connectors shall be listed in conformance with Underwriters Laboratories Standard UL467 and the National Electrical Code. Burndy Hyground Compression System connectors, matching tools, and crimping procedures, are one system of products which meet these specifications. Regardless of the source of the connectors, tools, and dies selected, the contractor shall submit catalog cuts or other manufacturer information, demonstrating that these items fit their intended applications as described above. See Paragraph 1A.4 above.
- h. Testing. Electrode grounds shall be tested for resistance intended applications as described above. See Paragraph 1A.4 above at each location. Resistance to ground for each grounding location shall be 10 ohms or less. If this value is not achieved with the grounding electrodes, as shown on the drawings, additional grounding electrodes, spaced at least 6 feet apart, or electrode extensions of the same construction and diameter, shall be installed until the resistance value does not exceed the maximum of 10 ohms. A tabulated report of the final resistance value at each location shall be provided to the Resident Engineer.
- 16A.5 SPARE FUSES. Unless specified otherwise, for every fused switch the contractor installs, he shall furnish the Resident Engineer one full set of spare fuses in addition to the fuses installed in the switch. If the drawings require more than one full set, the contractor shall comply with the drawings.
- 16A.6 GROUND FAULT INTERRUPTING RECEPTACLE. All outdoor receptacles provided by the contractor shall be ground fault interrupting duplex receptacles in properly sized weatherproof boxes.

- 16A.7 CABLE ABANDONMENT. Ends of cables to be abandoned shall be buried two feet below grade unless otherwise specified.
- 16A.8 WATERPROOFING CABLE ENDS. All cable ends which will be exposed to weather, water, ground, or corrosive environment prior to termination, shall be sealed against these elements while awaiting termination. This also applies to all cable ends in manholes or handholes. The sealing material shall be properly sized, easily removable heat shrinkable end caps (3M ICEC are acceptable), or electrical tape (see Paragraph 16A.21 below), with an application of brushed-on protective electrical coating.
- 16A.9 CONDUIT AND CABLING FOR ENGINE GENERATOR. Where engine generator standby power will be extended to a facility, conduit shall run continuously, without intermediate manholes or handholes, from the engine generator to the facility. In the continuous conduit, power cables shall be installed without splices from the engine generator bypass switch to the facility service entrance switch.
- 16A.10 ELECTRICAL EQUIPMENT NAME PLATES.
- a. Each of the following types of equipment shall be identified with a name plate showing the functional name of the unit, voltage utilized, one or three phase as applicable, and additional information if specified or requested by the Resident Engineer:
 - Switches (Except Local Lighting)
 - Panelboards
 - Main Circuit Breakers
 - Motor Controllers
 - b. Name plates shall be non-ferrous metal or rigid plastic, stamped, embossed, or engraved with 3/8-inch minimum height letters and numerals. Name plates shall be secured to the equipment with at least two screws, except main breaker plates may be epoxy glued.
- 16A.11 PANELBOARD CIRCUIT DIRECTORIES. The contractor shall clearly and neatly mark panelboard circuit directories, identifying each circuit he establishes, re-establishes, or changes, as to the circuit's function.
- 16A.12 COVERING HOLES IN ENCLOSURES. No electrical enclosure will be accepted which has an unused open hole, except weep holes or vent holes. Holes in enclosures where conduits, bolts, or other objects were removed and not reinstalled, shall be closed with panels of the same material, thickness, color, and shade as the enclosure.
- 16A.13 SAFETY DISCONNECT SWITCHES AND FUSES. Safety disconnect switches and fuses shall meet the following specifications.
- a. General. Unless specified otherwise, all switches for circuit voltages of 600VAC or less, shall be heavy duty (Type HD), UL listed, and shall bear the UL label. The switches shall be NEMA 1 or NEMA 3R, as required by the drawings or special specifications.
 - b. Switch Interiors. All switches shall have switch blades which are fully visible in the OFF position when the switch door is open. All current-carrying parts shall be of high-conductivity copper, designed to carry the rated load without excessive heating. Switches shall have removable arc suppressors where

necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60°C or 75°C, aluminum or copper wires.

- c. Switch Mechanism. Switches shall quick-make, quick-break, such that during normal operation of the switch, the operation of the contacts will not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not of the cover. Switches shall have provisions for padlocking the switches in the OFF position with at least three locks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the ON position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is ON or OFF.
- d. Enclosures. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 3R enclosures shall be securable in the open position. NEMA 3R enclosures for switches through 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall accommodate the conduits of the diameters indicated on the drawings. NEMA 3R enclosures shall be manufactured from galvanized steel. All enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel.
- e. Ratings. All fusible switches rated 100 through 600 amperes at 240 volts, and 30 through 600 amperes at 600 volts, shall have a UL-approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses, and have provisions for field installation of a UL-listed rejection feature to reject all fuses except Class R. The UL-listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL-listed short circuit rating of the switch, when equipped with Class H fuses, shall be 10,000 rms symmetrical amperes.
- f. Fuses. All fused switches meeting the above specifications shall be fused with dual element, time-delay, UL Class RK5 fuses, of the continuous current rating specified on the drawings. The fuses' interrupting rating shall be at least 10,000 rms symmetrical amperes. Bussmann Fusetron switch fuses are among the products that meet these specifications.
- g. Switches Meeting Specifications. The following eight Square D 240V, single phase, 3-wire switches, are among switches meeting the above specifications:
 - (1) 30-amp-rated, for indoor use, Cat. No. H221A, with field-installable solid neutral assembly Cat. No. H60SNC.
 - (2) 30-amp-rated, for outdoor use, Cat. No. H221AWK, with field-installable solid neutral assembly Cat. No. H60SNC.
 - (3) 60-amp-rated, for indoor use, Cat. No. H222A, with field-installable solid neutral assembly Cat. No. H60SNC.
 - (4) 60-amp-rated, for outdoor use, Cat. No. H222AWK, with field-installable solid neutral assembly Cat. No. H60SNC.
 - (5) 100-amp-rated, for indoor use, Cat. No. H223A, with field-installable solid neutral assembly Cat. No. H100SNC.

- (6) 100-amp-rated, for outdoor use, Cat. No. H223AWK, with field-installable solid neutral assembly Cat. No. H100SNC.
- (7) 200-amp-rated, for indoor use, Cat. No. H224A, with field-installable solid neutral assembly Cat. No. H200SNC.
- (8) 200-amp-rated, for outdoor use, Cat. No. H224AWK, with field-installable solid neutral assembly Cat. No. H200SNC.

16A.14 PANELBOARDS AND CIRCUIT BREAKERS. Panelboards and circuit breakers shall meet the following specifications.

- a. General. Unless otherwise specified, all panelboards for circuits of 240VAC or less, shall be surface mounted, and equipped with bolt-on circuit breakers with frame and trip ratings. Panelboards and circuit breakers shall be UL rated, and shall bear the UL label. When installed as service equipment, panelboards shall be suitable for use as service equipment.
- b. Circuit Breakers. Circuit breakers shall be one-pole or two-pole thermal-magnetic molded-case circuit breakers. The two-pole breakers shall have an integral crossbar to assure simultaneous opening of both poles. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have ON, OFF, and TRIPPED positions. In addition, trip indication shall include a visible trip indicator appearing in the window of the breaker case.

The circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware. Circuit breakers shall be UL-listed in accordance with UL Standard 489 and shall be rated 240 VAC maximum with continuous current ratings as noted on the drawings. Circuit breakers up to but not including an ampere rating of 70 amperes, shall have an interrupting rating of 10,000 rms symmetrical amperes for a 120/240VAC circuit. Circuit Breakers with ampere ratings of 70 amperes or more, shall have an interrupting rating of 22,000 rms symmetrical amperes for a 120/240 VAC circuit. Single-pole 15 and 20-ampere circuit breakers for routine switching of fluorescent lighting loads, shall carry the SWD marking.

- c. Bussing Assembly and Temperature Rise. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the drawings. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structures shall be insulated. All current-carrying parts shall be of high-conductivity copper, designed to carry the rated load without excessive heating.
- d. Cabinets and Fronts. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of the steel shall be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel. Each front shall include a door, and shall have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating

trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with the door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door.

e. Panelboards Meeting Specifications. The following panelboards are among panelboards which meet the above specifications.

(1) 12-Space Panelboards. Panelboards assembled from the following Square D components, including 100-amp main lug or 100-amp main circuit breaker (CB) interiors with 12 single-pole branch breaker spaces:

	<u>Indoor (NEMA 1)</u>	<u>Outdoor (NEMA 3R)</u>
Interior	NQOD12L100CU (main lugs) NQOD12M100CU (main CB's)	NQOD12L100CU (main lugs) NQOD12M100CU (main CB's)
Enclosure	MH20 (main lugs) MH23 (main CB's)	MH20WP (main lugs) MH23WP(main CB's)
Interior Trim Kit	None	MH20TK (main lugs) MH23TK (main CB's)
Circuit Breakers	QOB style	QOB style

(2) 20-Space Panelboards. Panelboards assembled from the following Square D components, including 100-amp main lug or 100-amp main circuit breaker (CB) interiors with 20 single-pole breaker spaces):

	<u>Indoor (NEMA 1)</u>	<u>Outdoor (NEMA 3R)</u>
Interior	NQOD20L100CU (main lugs) NQOD20M100CU (main CB's)	NQOD20L100CU (main lugs) NQOD20M100CU (main CB's)
Enclosure	MH23 (main lugs) MH26 (main CB's)	MH23WP (main lugs) MH26WP (main CB's)
Interior Trim Kit	None	MH23TK (main lugs) MH26TK (main CB's)
Circuit Breakers	QOB style	QOB style

16A.15 ELECTRICAL ENCLOSURES AND WIREWAYS. Unless specified otherwise, electrical enclosures and wireways shall meet the following specifications.

a. Material. Electrical enclosures and wireways shall be constructed of code gauge sheet steel.

- b. Corrosion-Resistant Coating. Enclosure and wireway sheet steel shall be coated by ASTM 525 G90 (galvanneal) galvanizing or corrosion-resistant phosphate primer, or both.
 - c. Finish. Finish shall be dark gray enamel inside and out, or ANSI 61 gray polyester coating inside and out, or ASA-49 gray epoxy paint inside and out.
 - d. Industry Standards.
 - (1) Enclosures. NEMA 1 enclosures shall meet NEMA Type 1 and UL 50 Type 1 standards. NEMA 3R enclosures shall meet NEMA Type 3R and UL 50 Type 3R standards.
 - (2) Wireway. NEMA 1 wireway (including troughs) shall meet NEMA 1 and UL 870 standards. NEMA 3R wireway (including troughs) shall meet NEMA 3R and UL 870 standards.
 - e. Hardware. All hardware shall be plated to prevent corrosion.
- 16A.16 FACILITY AC SURGE ARRESTER. The contractor shall furnish and install an AC surge arrester (power arrester) on the line side of the facility shelter service disconnecting means, as shown on the drawings. The arrester shall meet the following specifications.
- a. Operating Lifetime. The arrester shall safely dissipate the number and amplitude of surges listed in Table 1, below. In this table, the 8x20us waveform defines a transient with a rise time of 8 microseconds (us) from inception to peak value that exponentially decays to 50 percent of peak value 20us after inception.

TABLE 1: LINE-TO-GROUND SURGE LEVELS FOR 120/208V,
 120/240V, AND 277/480V AC SERVICES LINES
 (Tabulated values are from Table I of
 FAA-STD-019b, dated August 28, 1990.)

Surge Current Amplitude 8x20 Microsecond Waveform	Number of Surges (Lifetime)	
	100A or Less	Greater than 100A
10,000 amperes	1,000 surges	1,500 surges
20,000 amperes	500 surges	700 surges
30,000 amperes	250 surges	375 surges
40,000 amperes	25 surges	50 surges
50,000 amperes	1 surge	5 surges
60,000 amperes	0 surge	2 surges
70,000 amperes	0 surge	1 surge

Clamp (discharge) voltage shall not change more than ten percent over the operating life of the arrester.

- b. Operational Characteristics. The arrester shall have the following operational characteristics.
- (1) Reverse Standoff (Maximum Operating) Voltage. Reverse standoff voltage is the maximum voltage that can be applied across arrester terminals with the arrester remaining in an OFF (non-conducting) state. The reverse standoff voltage shall be 125 ± 5 percent of normal line voltage.
 - (2) Leakage Current. Leakage current shall not exceed 1 milliamp at reverse standoff voltage.
 - (3) Turnon Voltage. Turnon voltage is the minimum voltage across arrester terminals that will cause the arrester to turn on and conduct. Turnon voltage shall not exceed 150 percent of reverse standoff voltage.

- (4) **Clamp (Discharge) Voltage.** Clamp voltage (discharge voltage) is the maximum sustained voltage that appears across an arrester output terminal while conducting surge currents. For 120/240V and 120/208V arresters, clamp voltage, each phase to ground, either polarity, shall not exceed those shown in the following tabulation:

<u>Surge Current</u>	<u>Clamp Voltage</u>	<u>Surge Current</u>	<u>Clamp Voltage</u>
5,000 amps	400 volts	40,000 amps	900 volts
10,000 amps	480 volts	60,000 amps	1,100 volts
20,000 amps	650 volts	80,000 amps	1,350 volts

- (5) **Overshoot Voltage.** Overshoot voltage is the surge voltage that appears across the arrester terminals before the arrester turns on and clamps the surge to the clamp voltage. The overshoot voltage shall not exceed two times the arrester clamp voltage for more than 10 nanoseconds.
- (6) **Self-Restoring Capability.** The surge arrester shall automatically return to the OFF state after surge dissipation when line voltage returns to normal.
- (7) **Fusing and Lamps.**
- (a) The input to each arrester phase component shall be internally fused to protect the AC power supply equipment against overload should an arrester device short. This fusing shall not increase the clamp voltage of the arrester. The fusing shall pass the surge current levels given in Table 1 without opening. The arrester internal fusing shall open on application of a steady state current at a level low enough to prevent damage to the AC power supply. The multiple arrester phase components shall be individually fused. A failed component shall blow its own fuse, and be automatically removed from the circuit, with the remaining components providing continued protection.
- (b) **Lamps.** Each phase shall have two indicator lamps in parallel, to continuously monitor the arrester condition. The lamps shall be coordinated with the fuses such that the lamps dim or go out when the last arrester component remains. The arrester elements shall be connected line-to-neutral.
- c. **Composition and Construction.** All components of the arrester shall be assembled and mounted in a single NEMA 4 waterproof enclosure. Heavy duty, screw-type studs shall be provided for all input and output connections. The arrester elements shall be connected line-to-neutral. The arrester shall have an internal means of easily disconnecting incoming power, so the arrester may be maintained without disconnecting facility power. The arrester elements shall be electrically isolated from the enclosure to a minimum of 10 megohms resistance. The enclosure door shall be hinged and electrically bonded to the enclosure when shut. The hinges shall not be used to provide electrical bonding. Indicator lamps shall be mounted on the front door. Fuses, lights, fuse wires, and arrester components shall be readily accessible for inspection and replacement.
- d. **Arrester Meeting Specifications.** For 120/240V, single phase, 60Hz applications, the Lightning Protection Corporation (Goleta, California) Model No. LPC 20206-7 AC surge arrester is one of the products that meet the above specifications. If

the contractor intends to furnish a substitute, or if a different power configuration must be accommodated, the contractor shall submit to the Contracting Officer, full manufacturer's literature on the substitute arrester, and shall not procure the substitute before receiving the Contracting Officer's approval. See Paragraph 1A.4 above.

- e. Installation. The arrester shall be installed as close as practical to the facility service disconnecting means, but not more than 12 inches away from the disconnecting means. Wiring connections shall be on the line side of the service disconnecting means.
- (1) Phase Cables. Surge arrester phase lugs shall be connected to corresponding phase terminals of the service disconnecting means with insulated #4 AWG (minimum gauge) stranded copper cable. These cables shall be as short and shall run as directly as feasible, without loops, sharp bends or kinks.
 - (2) Surge Grounding Cable. The surge grounding cable shall be routed as directly as feasible, without loops, sharp bends or kinks, from the surge grounding terminal:
 - (a) To the nearest grounding electrode, or
 - (b) To the neutral bus in the service disconnecting means, if so shown on the drawings.

The surge grounding cable shall be insulated #4 AWG (minimum gauge) stranded copper cable. This cable shall be color coded white when connected from the arrester to the service disconnecting means.

- (3) Equipment Grounding Conductor. The surge arrester enclosure shall be connected to the ground bus in the service disconnecting means enclosure with a #6 AWG green insulated copper cable.

16A.17 SHELTER ENVIRONMENTAL AND LIGHTING EQUIPMENT. If required on the drawings, equipment for an equipment shelter (building) nominally sized 10'x12', shall meet the following specifications.

- a. Vent Fan. For a MALSR shelter, the vent fan shall be at least 1/25 HP, and shall move at least 424 CFM at zero gauge pressure. Greenheck Model GW-75-D is one of the products that meet these specifications. For an ILS shelter, the vent fan installation shall be supplemented with a power damper and two-position damper motor. The Honeywell D640 power damper with two-position damper motor Honeywell M436A116, is one of the products that meet these specifications. The intake damper for the ILS shelter shall be a power damper with two-position damper motor identical to the vent fan power damper.
- b. Vent Fan Thermostat. The vent fan thermostat shall be a 120VAC wall-mounted airswitch controller operating in a temperature range from at least 35° to 95°F. Honeywell Part No. T651A is one of the products that meet these specifications. This item applies to buildings without environmental control panels, e.g., MALSR and ILS marker shelters.

- c. Heater. The heater shall be a 240V, 4,000-watt wall-mounted electric heater with surface mounting box. The QMark Cat. No. AWH-4404 heater is one of the products that meet these specifications.
 - d. Heater Timer Unit. The heater timer unit shall consist of a 1-hour 240-volt manual timer, and contactor with 208/240-volt coil and 30-amp rated contacts, mounted on and in a minimum 12"x12"x4" NEMA 1 hinged cover box with matching mounting panel. The following components are among components that meet these specifications: Timer, Dayton Stock No. 6X546; contactor, Honeywell Part No. R4243B1046; enclosure, Hoffman Cat. No. A-12N124, with A-12N12P mounting panel. The heater timer unit is applied to buildings without environmental control panels, e.g., MALSR and ILS marker shelters.
 - e. Air Conditioner. The air conditioner shall be nominally 240V (unless specified otherwise on the drawings), front air discharge model, with EER of at least 9.0, and shall have either a through-wall sleeve or a slide-out chassis. Air conditioners are applied to buildings with environmental control panels, e.g., ILS localizer and glide slope shelters.
 - f. Interior Light Fixture and Lamps. Each interior light fixture shall be surface mounted, 120-volt, having a white-painted steel chassis and a light-controlling plastic lens enclosure. The lens enclosure shall be of a wraparound style which illuminates the ceiling as well as the room. The fixture shall be nominally four feet long, and shall accommodate two 48"-long T-8 fluorescent lamp tubes. The ballast shall have a radio frequency suppressor. The ballast shall operate normally at temperatures above 20°F. The lamp tubes shall be 32-watt 48"-long T-8 fluorescent lamp tubes, each with an initial rating of 2,850 lumens. The Holophane Prismawrap Cat. No. M7100-4-1-A-6 light fixture is among fixtures which meet these specifications. The following 32-watt lamp tubes are among lamps which meet these specifications: General Electric Trimline, Philips TL70, and Sylvania Octron.
 - g. Exterior Light Fixture. The exterior light fixture shall be a 50-watt high pressure sodium unit, rated for 24,000-hour lamp life, having a cast aluminum housing, and a photocontrol installed inside the housing. Holophane Wallpockette luminaire, Cat. No. WP-2-A-050HP-12-GR-P, is among products which meet these specifications.
- 16A.18 SHELTER LIGHTNING PROTECTION EQUIPMENT. All shelters (buildings) shall have a lightning protection system installed per the requirements of the Lightning Protection Code, National Fire Protection Association (NFPA 78), and Underwriters Laboratories Master Labeled System (UL96A). Specific lightning protection equipment items shall meet the following specifications. Catalog numbers given in a through k below, are of Thompson Lightning Protection, Inc. of St. Paul, Minnesota.
- a. Air Terminal Point. Air terminal points shall be nickel-tipped copper, 1/2" diameter x 36" long. Cat. No. 660 meets these specifications.
 - b. Point Bracket. For a roof ridge, the point bracket shall be made of pressed copper, shall bend to fit any roof slope, and shall hold the point and cable slightly above the center of the roof ridge. The bracket shall have a pressure cable clamp, and a stud to engage the point. Cat. No. 532 meets these specifications.

- c. Air Terminal Brace. The air terminal brace shall be a 36"-long galvanized tripod assembly, with legs adjustable to accommodate any roof slope. Cat. No. 83 meets these specifications.
- d. Roof and Down Conductors. Roof and down conductors shall each have 32 strands of #17 copper wire, 7/16" overall diameter, braided smooth twist, 65,500 circular mils, and a net weight of 215 pounds per 1000 feet. Cat. No. 32 meets these specifications.
- e. Ridge Cable Support. Ridge cable supports shall be pressed copper cable supports at least 2" wide, to hold the roof cable above the top of the roof. The ridge cable supports shall be sized to accommodate the roof conductor. Cat. No. 533 meets these specifications.
- f. Cable Holder. Cable holders shall be 1"-wide copper bent-strap type loops with 1/4" mounting holes. The cable holders shall be sized to accommodate the roof conductor. Cat. No. 166XX meets these specifications.
- g. Parallel Clamp. Parallel clamps shall be bronze 2"-long clamps for connecting two conductors together, one conductor of maximum diameter 1/2", and the other conductor from 1/6" dia to 5/16" dia. Cat. No. 565 meets these specifications.
- h. Flexible Bonding Strap. Flexible bonding straps, for connecting steel doors to steel door frames, shall be braids each composed of 480 #30 copper wires, with flat bronze or copper connectors crimped on at each end. The connectors shall have holes to take either 5/16" or 3/8" machine screws.
- i. Pipe Clamp. Pipe clamps shall be adjustable tinned bronze clamps for bonding cables to pipes, and fitting pipes up to and including 1 1/4" O.D., and cables up to and including 1/2" diameter. Cat. No. 240 meets these specifications.
- j. Bonding Equipment. Bond the steel siding, vent fan, hood, door frame, junction boxes, and any miscellaneous exterior metal objects to down conductors. If included, air conditioners, junction boxes, and flight check antenna masts shall be likewise bonded. Use the following equipment to perform the bonding:
 - (1) Bonding Plate. Bonding plates shall be 8-sq. inch tinned bronze plates with 2"-long pressure type cable connectors, designed to bond a continuous run of cable to metallic objects along their path. Each plate shall have two holes fitting sheet metal screws or 1/4" machine screws. Cat. No. 702 meets these specifications.
 - (2) Bonding Conductor. Bonding conductor shall be minimum #6 bare soft drawn copper, 1/6" dia, 26,250 circular mils, net weight 80 pounds per 1000 feet. Cat. No. 14X (#6 bare solid) and Cat. No. 509X (#4 bare solid) meet these specifications.
- k. Ground Rod Clamps. In the grounding access well, the #6 grounding electrode conductor shall be connected to the 3/4"-diameter grounding electrode with a bronze 2-bolt ground rod clamp. Cat. No. 519 meets these specifications. In the

grounding access well, the 4/0 counterpoise cable (perimeter ground) shall be connected to the 3/4"-diameter grounding electrode with a bronze clamp which will accept one vertical cable and one horizontal cable. Cat. No. 693 meets these specifications.

- I. Grounding Access Well Frame and Lid. If shown on the drawings, the frame and lid of the grounding access well shall fit snugly into the opening of a 15"-diameter corrugated pipe. The frame and lid shall be ASTM A48 Class 35B gray cast iron. The lid shall be solid, not of an open construction. Neenah Foundry Co. (Neenah, Wisconsin) Cat. No. R-5900-B is one of the products that meet these specifications.
- 16A.19 CONTROL CABLE TERMINAL STRIPS. Unless specified otherwise, contractor-furnished control (telephone) cable terminal strips shall be units assembled from compatible components all from the same manufacturer. The individual blocks of the strips shall be miniature style (1/4" O.C.) nylon blocks with screw-activated tubular conductor clamps. The blocks shall be rated for a maximum voltage of at least 300 volts and a maximum current of at least 30 amperes. The conductor clamps shall accept wire sizes at least from #14 to #22. Stab-in wire connection blocks shall not be used. The blocks shall be mounted in a mounting channel. The assembled strip of blocks shall have a marking strip and holding plugs or end barriers. For terminating control cables on these strips, see Paragraph 16F.7 below. The following terminal strip components are among components which meet these specifications:
- a. Buchanan: Blocks No. 125 mounted in channel No. 12 with clamps No. 11. Marking strip No. 15. Holding plug No. 16.
 - b. Square D: Blocks No. GM-3, with mounting channel and marking strip of the GH series, with end barrier No. GM3B.
- 16A.20 FRANGIBLE COUPLINGS.
- a. Material Specification. Unless specified otherwise, contractor-furnished frangible couplings shall be 2" diameter cast aluminum couplings having a hexagonal clamping ring. The couplings shall accommodate 2"-diameter EMT conduit, and shall meet Military Specification MS-17814-1. Frangible coupling Cat. No. 961A by Multi Electric Mfg., Inc. of Chicago, Illinois, is one of the products that meet these specifications.
 - b. Thread Remediation. Often, the conduit threads of frangible couplings (both contractor-furnished and Government-furnished) are cast with mismatched halves. Often, this imperfection causes the threads to bind in the rigid coupling threads conduit threads of the required mating object), before the required engagement is reached, even when anti-seize compound is used. When this binding occurs, the contractor shall rework the frangible coupling threads to achieve the required thread engagement. This remediation may consist of rethreading with a straight conduit thread die, and/or of grinding off the threads on the two diametrically opposite sides of the thread helix where the cast thread discontinuity is found. This remediation must continue until the required thread

engagement is achieved. All burrs and galls must be removed from the reworked threads.

- c. Installation. For approach lighting systems, see Paragraph 13A.2c. For VASI, REIL, PAPI, and RVR, see Paragraph 13C.2b.

16A.21 ELECTRICAL TAPE. Unless specified otherwise, electrical tape shall meet the following specifications. The tape material shall be based on PVC polyvinyl and/or PVC copolymers. The tape shall have a rubber-based, pressure-sensitive adhesive. The tape shall be 8.5 mils thick, and be UL listed and marked per UL Standard 510 as "Flame Retardant, Cold and Weather Resistant." The tape must be applicable at temperatures ranging from 0°F through 100°F (-18°C through 38°C). The tape shall be classified for both indoor and outdoor use. The tape shall be compatible with synthetic cable insulations, jackets, and splicing compounds. Scotch Super 88 Vinyl Electrical Tape by 3M is one of the products that meet these specifications.

16A.22 PRE-STRETCHED RUBBER TUBING. Pre-stretched rubber tubing shall be open-ended tubular rubber sleeve, factory expanded and assembled onto a removable core. The tubing is supplied for field installation in this pre-stretched condition. The tube is positioned for installation over an inline connection, terminal lug, sleeve splice, or other cable insulation discontinuity requiring protection. Then the core is removed, allowing the tube to shrink to produce a waterproof seal.

The tubing shall be made of EPDM (ethylene propylene diene methylene) rubber containing no chlorides or sulfurs. The tubing must be capable of operation at emergency overload cable temperatures of 130°C. It must be usable without additional covering or adhesive, both indoors and outdoors, in overhead, direct buried or submerged applications, on cables rated up to 1,000 volts. The tubing must be applied without additional heat or flame and, when applied per the manufacturer's instructions, be immediately energizable. It must not be adversely affected by moisture, mild acids or alkalis, ozone or ultraviolet light. It must conform to the requirements of ANSI C119.1 1974, appropriate sections of Western Underground Guide 2.14 and UL 486D. The tubing must have been accepted by the U.S. Department of Agriculture, Rural Electrification Administration (REA), for both submersible and aerial application. PST Cold Shrink Connector Insulators 8420 Series by 3M are among products which meet these specifications. All applications must be performed per the manufacturer's instructions.

16A.23 FIRE AND ARC PROOFING. Fire and arc proofing shall consist of a flexible conformable unsupported (having no adhesive) intumescent elastomer. The intumescent property causes the tape to expand in fire, thus providing an insulating firewall between the flame and cable. The tape shall be not less than .030 inches thick. The tape shall be capable of over 100% elongation. The tape shall be non-corrosive to metallic cable sheaths. It shall be compatible with synthetic cable jackets such as semi-conducting URD type, polyethylene, and PVC. The tape shall be self-extinguishing, i.e., shall not support combustion. The tape shall not deteriorate when subjected to water, salt water, gases, and sewage. The wrapped tape shall be secured by a band consisting of two layers (the second wrapped directly over the first) of glass cloth electrical tape at both ends of the fire and arc proofing wrap. The completed installation of a single half-lapped layer of fire and arc proofing shall be

capable of withstanding a high 60 Hz current fault arc temperature of 13,000°K for 70 cycles. Scotch 77 Fire and Arc Proofing tape secured with Scotch 69 Glass Cloth Electrical Tape are among products that meet these specifications, when applied per the manufacturer's instructions. All applications must be performed per the manufacturer's instructions.

16A.24 CABLE CONNECTOR PROTECTION.

- a. Primary Connections. Where single-conductor plug and receptacle cable connectors are joined in light bases or other underground enclosures, the joint shall be sealed with heat-shrinkable tubing specifically designed for this purpose. Each tubing unit shall consist of a polyolephin heat-shrinkable sleeve with sealant at each end. The tubing shall meet the performance specifications of ANSI C-119.1 and Western Underground Guide (2.5, 2.4), and shall be REA listed under "secondary" tap or splice cover, submersible.

The sleeve is placed over the cable connectors, their joint, and a short length of cable at the ends of the connectors. The sleeve is shrunk with a torch or heat gun, with heat applied from the center of the sleeve toward the ends, to avoid trapping air. The sleeve shrinks under the heat, to conform to the shape of the connectors and the cables. The sealant at the ends of the sleeve forms a watertight seal around the cables. These sleeves shall be applied to cable connector joints between two isolation transformer primary leads, a primary lead and a cable, or two cables, wherever these joints are specified in a light base or other underground enclosure. The sleeves must be of a type designed for easy removal by applying a small amount of heat, slitting the sleeve with a knife, and peeling away the sleeve. Airport Lighting Connector Protection tubing, Series APL-823A, by Sigmaform Corporation of Vicksburg, Mississippi, is one of the products that meet these specifications. Substitutes require submittals per Paragraph 1A.4 above.

- b. Secondary Connections. Where two-conductor plug and receptacle cable connectors are joined in light bases or other underground enclosures, the joint between the two connectors shall be sealed with at least two layers of electrical tape and an application of protective electrical coating. Where two-conductor plug and receptacle connectors are joined in a frangible coupling, apply no tape or any other protection.

16A.25 ELECTRICAL COATING. Cable connections, splices, or other joints wrapped with plastic electrical tape, shall be sealed with an electrical coating meeting Military Specification MIL-P-18623. Scotchkote electrical coating is among the products meeting this specification.

16A.26 COMMERCIAL METAL FRAMING. Where specified for mounting of electrical equipment or other purpose, the contractor shall furnish and install commercial metal framing. The channel framing members shall be formed from strip steel, with one side of the channel having a continuous slot with inturned lips. The principle of attachment is application of nuts which engage the inturned lips of the channel. For outdoor applications, framing members shall be hot-dip galvanized per ASTM Specification A-

123 or A-153. For indoor applications, 16A.26 framing members shall be factory coated with enamel or epoxy coatings, or electro-galvanized per ASTM Specification B633, or pre-galvanized with a G90 zinc coating per ASTM Specification A-525. Uncoated framing members, or framing members coated only with oil, are not acceptable. Properly sized and matched channel framing members, fittings, and hardware from Unistrut Corporation of Wayne, Michigan, and from B-Line Systems, Inc. of Highland, Illinois are among products meeting the above specifications. Installation shall be in accordance with manufacturer's instructions.

- 16A.27 EXPANSION COUPLING. Where shown on the drawings, rigid metal conduits which emerge vertically from below grade to make a direct connection to an above-grade junction box or structure, shall be fitted with an expansion coupling. The purpose of the expansion coupling is to accommodate relative vertical movement, such as the movement due to frost heave. The coupling shall be rigid metal, and shall be threaded onto the rigid conduits at both ends of the coupling. The coupling must accommodate 8 inches of movement, unless space limitations prohibit installing such a coupling. If there are such space limitations, a coupling allowing only 4 inches of movement may be substituted. For expansion couplings accommodating 8 inches of movement, couplings of the Appleton XJ-8 series are among couplings meeting these specifications. For expansion couplings accommodating 4 inches of movement, couplings of the Appleton XJ-4 series are among couplings meeting these specifications. Electrical continuity across the expansion coupling must be maintained by installing a bonding jumper. Bonding jumpers of the Appleton XJB-4 series meet these specifications for 4"-movement expansion couplings. Bonding jumpers of the Appleton XJB-8 series meet these specifications for 8"-movement expansion couplings.

CADWELD EXOTHERMIC WELDING KITS

GROUNDING ELECTRODE	CABLE SIZE (RUN WIRE)	CABLE SIZE (TAP WIRE)	CONNECTION TYPE DESIGNATION	WELD METAL	CONNECTION DESCRIPTION
			AND MOLD NUMBER		
Copperclad		#6 Solid	GR GRT-181G	32	These are connections in which a horizontal copper cable terminates at the top of a vertical 3/4" grounding electrode.
		#6 Stranded	GR GRT-181H	32	
		#2 Stranded ¹	GR GRC-188D ²	115	
Stainless Steel		#6 Solid	GR GRT-331G	32	
		#6 Stranded	GR GRT-331H	32	
		#2 Stranded ¹	GR GRC-338D ²	115	
Copperclad	#6 Solid		GT GTP-181G	45	These are connections in which a through run cable connects to the top of a vertical 3/4" grounding electrode.
	#6 Stranded		GT GTP-181H	45	
Stainless Steel	#6 Solid		GT GTP-331G	45	
	#6 Stranded		GT GTP-331H	45	
Copperclad	#4/0 Stranded		GY GYE-182Q	150	These are connections in which a through run cable connects to the side of a vertical 3/4" grounding electrode.
Stainless Steel	#4/0 Stranded		GY GYE-332Q	150	
	#6 Solid	#6 Solid	PC PCC-1G1G	25	PC designates parallel connections of horizontal cables, with the tap on top.
	#6 Stranded	#6 Stranded	PC PCC-1H1H	25	
	#2 Stranded	#6 Solid	PC PCC-1V1G	32	
	#2 Stranded	#2 Stranded	PC PCC-1V1V	65	
	4/0 Stranded	4/0 Stranded	TA TAC-2Q2Q	150	
	4/0 Stranded	#32 Thompson	TA TAC-2Q8C	115	
	4/0 Stranded	#506 Thompson	TA TAC-2Q8F	150	TA designates tee connections of horizontal run and tap cables.

NOTE: 1. Lightning conductor, #2 copper stranded 17 AWG, 59500 CM, 187.5 lb/1000 ft., IPC #32S, approximately 15/32" diameter.
 2. Use Cadweld E-Z Change Handle, Catalog Number L-160, when using this mold.

DIVISION 16 – ELECTRICAL SECTION 16B 600-VOLT POWER CABLE FOR UNDERGROUND INSTALLATION

- 16B.1 SCOPE. This section covers the material requirements for all contractor-furnished single-conductor 600-volt power cable required for direct earth burial installation. Installation of power cable is covered in Section 16F.
- 16B.2 GENERAL REQUIREMENTS. Cable construction shall include copper single conductor and XLP (thermosetting crosslinked polyethylene) insulation. Cable shall be UL listed as Type USE or RHW or RHH for use in circuits not exceeding 600 volts at conductor temperatures of 90°C for continuous normal operation, 130°C for emergency overload conditions, and 250°C for short circuit conditions. Cables shall be suitable for direct burial and above-grade installation in wet or dry locations.
- 16B.3 APPLICABLE SPECIFICATIONS.
- a. Underwriters Laboratories Standard 854 for Service Entrance Cables.
 - b. Underwriters Laboratories Standard 44 for Rubber-Insulated Wires and Cables.
 - c. ICEA Publication Number S-66-524, NEMA Publication Number WC7 for Crosslinked Polyethylene-Insulated Wire and Cable.
 - d. Federal Specification J-C-30A.
- 16B.4 CABLE CONSTRUCTION. Cable characteristics shall include the following materials and construction:
- a. Conductors. Conductors shall be solid or Class B stranded annealed uncoated copper, per UL Standards 854 and 44.
 - b. Separator. A suitable separator over the conductor may be used at the option of the manufacturer.
 - c. Insulation. Each conductor shall be insulated with XLP (crosslinked polyethylene) complying with the physical and electrical requirements of UL Standard 854 for Type USE and UL Standard 44 for Types RHW and RHH and Paragraph 3-6 of ICEA Publication Number S-66-524. The insulation shall be applied lightly to the conductor and shall be free-stripping.
- 16B.5 IDENTIFICATION. The cable shall be identified by surface marking indicating manufacturer's conductor size and metal, voltage rating, UL Symbol and type designation, and year of manufacture.
- 16B.6 TESTS. Cable shall be tested in accordance with requirements of UL Standard 854 for Type USE, UL Standard 44 for Types RHW and RHH, and ICEA Publication Number S-66-524, Paragraph 3.6.
- 16B.7 DATE OF MANUFACTURE. Year of manufacture of all cable shall be no earlier than one calendar year immediately preceding contract award date.

16B.8 PACKAGING. All cable shall be provided on wooden or steel reels, and ends of all cable shall be sealed to prevent entry of moisture. All reels shall identify type, length, and year of manufacture of cable packaged on such reels. All such identification shall be clearly provided by the manufacturer.

DIVISION 16 – ELECTRICAL SECTION 16E CONTROL CABLE

16E.1 SCOPE. This section covers the material requirements for all contractor-furnished exterior standard and gopher-resistant filled control (telephone) cable to be installed as shown on the drawings. Installation of control cables is covered in Section 16F.

16E.2 APPLICABLE SPECIFICATIONS.

- a. United States Department of Agriculture, Rural Electrification Administration (REA), Specification PE-39 for "Filled Telephone Cable" (Bulletin 345-67) latest edition, including all addendums and attachments thereto, forms a part of these specifications and is applicable in its entirety.
- b. Certain requirements, specified herein, supplement the requirements of Specification PE-39, and shall receive special attention by the cable manufacturer and contractor.

16E.3 GENERAL REQUIREMENTS.

- a. Definition. The term "control cable" used throughout these specifications and on the project drawings is a general FAA term for cable used to transmit voice and control functions. The required cable is termed "telephone" or "telephone exchange" cable by the cable manufacturing industry.
- b. Quality. All control (telephone) cables shall be the standard products of a single major cable manufacturer and shall be designed and manufactured according to the highest industry standards. All cables shall be free of any imperfection which could affect serviceability and design life.

16E.4 STANDARD CABLE CONSTRUCTION. Cable requirements, complying with these specifications and Specification PE-39, include the following materials and construction.

- a. Conductors. #19 AWG solid annealed copper.
- b. Conductor Insulation. Solid polypropylene or polyethylene color coded in accordance with telephone industry "standard" coding.
- c. Twisted Pairs. Individual conductors twisted into pairs with varying lays to minimize crosstalk.

- d. Forming of Cable Core. Cables having 25 pairs or less are assembled into a single cylindrical group. Cables having more than 25 pairs are assembled in units, each individually identified by color coded unit binders.
- 16E.4e
- e. Filling Compound. Water resistant non-hardening compound to fill and seal all interstices between the conductor pairs.
- f. Core Covering. Non-hygroscopic dielectric tape.
- g. Flooding Compound. Water resistant and bonding compound to fill all voids between the core wrap and shield and between the shield and jacket.
- h. Shield. Corrugated electrically continuous and longitudinally applied 0.008 inch coated aluminum or 0.005 inch copper.
- i. Jacket. High molecular weight polyethylene or high-molecular weight ethylene copolymer.

16E.5 GOPHER-RESISTANT CABLE CONSTRUCTION.

- a. General. If gopher-resistant cable is required by drawings or special specifications, cable construction shall comply with all construction requirements for standard cable in Subsection 16E.4 above (including conformance with REA Specification PE-39) excepting for item h, "Shield", which shall comply with the following:
- b. Gopher-Resistant Shield. Corrugated electrically continuous and longitudinally applied overlapping metal shield consisting of one of the following materials:
- (1) 0.010 inch copper.
 - (2) 0.006 inch copper/stainless steel/copper bimetallic alloy.
 - (3) 0.007 inch Alloy 194 for 6 pr #19 cable.
 - (4) 0.006 inch Alloy 194 for cables larger than 6 pr #19.
 - (5) 0.008 inch coated aluminum with 0.006 inch coated steel.

16E.6 CABLE IDENTIFICATION. In accordance with Specification PE-39, all cable shall have jacket printed at periodic intervals with the name of the manufacturer, manufacturer's standard designation, year of manufacture, number of pairs, conductor gauge, sequential length marks, and notation signifying compliance with Specification PE-39 (if not clearly referenced in the manufacturer's submittals). In addition, the gopher-resistant shield shall be clearly identified.

16E.7 DATE OF MANUFACTURE. Year of manufacture of all cable shall be no earlier than one calendar year immediately preceding contract award date.

16E.8 PACKAGING. In accordance with Specification PE-39, all cable shall be stored and shipped on reels affording the required protection. Thermal wrapping shall be provided and ends of all cables shall be capped against exposure to moisture. All reels shall be labeled by the manufacturer and shall bear the manufacturer's name, year of manufacture, REA cable designation, description of cable, actual shipping length, and identification referenced to tests of record as required herein.

16E.9 TESTS.

- a. All project cable furnished shall satisfy all test requirements of Specification PE-39. Records of all such tests shall be retained by the manufacturer, according to Paragraph 29 of Specification PE-39, and shall be promptly made available to the Federal Aviation Administration upon request. All tests shall be specifically and clearly referenced to all reels of cable furnished.
- b. Basic cable design, for all project cable furnished, shall have proven acceptable to REA through "qualification testing" according to Paragraph 27 of Specification PE-39.
- c. Electrical tests, according to paragraph 28.1 of Specification PE-39, shall be performed on 100 percent of all project cable furnished.
- d. Quality assurance (capability) tests, according to Paragraph 28.2 of Specification PE-39, shall be performed on such periodic production basis so as to represent quality of all project cable furnished.

16E.10 SUBMITTALS. Prior to procuring any cable specified herein, the contractor shall submit the following documents for the specific cable that the contractor proposes to use, to the Contracting Officer, and receive written approval therefrom (see Paragraph 1A.4 above):

- a. Manufacturer's complete cable specifications, including manufacturer's statement of compliance with REA Specification PE-39.
- b. Drawing showing cable construction details.

DIVISION 16 – ELECTRICAL SECTION 16F CABLE INSTALLATION

16F.1 DESCRIPTION OF WORK. The extent of work is indicated on the drawings and by the provisions of this section. Included in this section are installation, splicing, and testing of power and control cables.

16F.2 GENERAL REQUIREMENTS.

- a. Service Interruptions. Existing sources of power and control are indicated on the drawings. For circuits actively in use, the contractor shall coordinate temporary interruptions of service with users and suppliers, the Resident Engineer, and the airport management.
- b. Cable Protection.
 - (1) All cable ends which will be exposed to weather, water, ground, or corrosive environment prior to termination, shall be sealed against these elements while awaiting termination or splicing. This requirement also applies to all cable ends in manholes or handholes. The sealing material shall be properly sized, easily removable heat shrinkable end caps (3M ICEC are acceptable), or electrical tape (see Paragraph 16A.19 above), with an application of brushed-on electrical coating.
 - (2) Cables shall not be bent at radii less than radii recommended by the manufacturer, or 10 times cable diameter (12 times diameter for armored cable), whichever is greater. Any cables damaged in any way by sharp bending shall be replaced.
 - (3) Special care should be taken when working with filled cables, especially when the temperature is below 35⁰F. This type of cable becomes more difficult to bend and work as the temperature decreases, and there is a possibility of cable damage at temperatures near 0⁰F.
- c. 600-Volt Wire and Cable Color Coding.
 - (1) All single conductor 600 volt wire and cable for 120/240 volt power circuits shall be color coded black for line 1, red for line 2, and white for the neutral.
 - (2) For conductor sizes smaller than #8 AWG, conductor insulation shall be color coded. For sizes #8 AWG and larger, and for armored power cable, colored tape shall be used to identify the conductors if insulation is not color identified.

- (3) Conductors shall be color-coded in junction boxes, square duct, terminal boxes, or any other place accessible to view. In no case shall green be used for other than grounding, nor white for other than the system grounded (neutral) conductor.
- d. Designation of Armored Cable. On drawings and other contract documents, the letter A immediately following the AWG number of a cable, indicates that the cable is armored (e.g., 3/C #8A, 600V).

16F.3 DIRECT-EARTH BURIAL CABLE INSTALLATION.

- a. Installation Method. Unless otherwise specified, outdoor cables running from one structure or item of equipment to another, shall be direct earth buried. Direct-earth burial cables shall be installed either by the trench and backfill method or by the cable plowing method in accordance with all the requirements specified herein.
- b. General Requirements.
 - (1) Underground cables shall be installed in straight lines between terminating locations or points of directional change.
 - (2) Unless otherwise specified, cables shall be installed a minimum of 24 inches and 30 inches below finished grade on airport property and off airport lands, respectively.
 - (3) Wherever possible, cable shall be installed in one continuous length without splices from connection to connection. The number of splices shall be kept to a minimum. Cable ends shall be effectively sealed against moisture immediately after cutting any type of cable. See the MALSR splice restrictions of Paragraph 13A.6.
 - (4) The contractor shall prepare a schedule for installing each reel of underground cable and shall submit it to the Resident Engineer for approval before installing any cable. The plan shall be predicated on use of the longest practical lengths of cable, in order to minimize splicing.
 - (5) A cable loop of at least three feet shall be left on each end of every cable run, on at least one side of every splice, and at all points where cable is brought above ground. A 3-foot minimum surplus cable length shall be left on both sides of splices in handholes and light bases. The slack loop shall be installed with the same minimum depth requirements as the cable run. Where cable is brought above ground, enough additional slack cable shall be left to make the required connections.
- c. Trench and Backfill Installation Method.
 - (1) Comply with all trenching, backfilling, compaction, and restoration requirements in Division 2.
 - (2) The contractor shall unreel the cable adjacent to or over the trench and manually place it in the trench. Do not pull the cable into the trench or drag it along the trench.

- (3) Where more than one cable is installed in the same trench, maintain separation as hereinafter specified. Multiple cables shall be installed in the same relative positions throughout the cable trench. Cables shall not be stacked, crossed or intertwined in any manner.
- d. Cable Plowing Method.
- (1) Vibratory cable plowing equipment, adequate for installation of the types of cables to be installed and for the depth required, may be used, provided that soil conditions are suitable, equipment is in good working order, and proper installation procedures are utilized.
 - (2) While cable is being plowed into place, one person in addition to the operator of the plowing vehicle shall be present to assure that the cables do not kink or bind tightly while entering the plow.
 - (3) If, during plowing operations, it appears that the soil contains sharp objects, rocks over 2 inches in diameter, or any other hazard to the cable, plowing shall be discontinued, and the Resident Engineer notified. The Resident Engineer shall determine whether plowing will be allowed to continue, or whether another cable placement method shall be used.
 - (4) The slice left by the plow shall be closed by tamping or other approved method, after cable placement, to minimize the disturbance of the surface by the slice.
- e. Cable Separation - Direct Burial.
- (1) Where new buried power cables cross over or under control or telephone cables, power cables shall be installed in a length of PVC duct extending two feet each side of the crossing. Minimum separation shall be twelve inches.
 - (2) Power cables of the same circuit may be laid together in the trench without separation, except as noted below. Series lighting cables may be considered being of the same circuit.
 - (3) Power cables, of the same or different circuits of less than 600 volts, may be laid together in the same trench without separation.
 - (4) All power cables, 5,000 volts and below, shall be separated from all control, telephone and coaxial type cables by a minimum of 6 inches.
 - (5) Power cable, of more than 5,000 volts, shall be separated from all other cables by a minimum of 12 inches.
 - (6) Control, telephone, and coaxial cables may be laid in the trench without separation from each other.
- f. Buried Ground Wire (Counterpoise). Unless specified otherwise, all direct-earth burial power, control and coaxial cables shall include the installation of #6 bare copper ground wire (counterpoise) per Paragraph 16A.4e above.
- g. Cable Markers.
- (1) Cable runs shall be marked by concrete cable markers according to project drawings. Cable markers for underground cable shall be installed at all changes of direction in cable runs, at 300 feet intervals in straight-line cable run segments, and at all splice locations.

- (2) Markers shall not be poured in place. The markers shall be installed flat in the ground immediately above the cable and with approximately one inch projecting above the surface. Impress additional circuit identification symbols on markers if so directed by the Resident Engineer. Existing cable markers removed or displaced shall be replaced after installation of new cable.

16F.4 CABLE INSTALLATION IN UNDERGROUND DUCTS AND CONDUIT.

a. Precautions.

- (1) Because almost all cable failures are caused by mechanical damage occurring during installation, the contractor should employ workmen experienced in underground cable installation, and utilize all the proper and unique equipment necessary for successful cable installation. Excessive direct tension, excessive sidewall pressure, sidewall impact, abrasion, sharp bending, and moisture intrusion will either destroy or shorten the useful life of cables installed.
- (2) The following conditions and installation procedures, capable of damaging cable, shall be avoided:
 - (a) Sediment in ducts.
 - (b) Scoring of duct bends by pulling ropes.
 - (c) Inadequate support of guiding pulleys and pull tubes, resulting in binding of mechanisms and misalignment.
 - (d) Inadequate cable and duct lubrication, especially at bends.
 - (e) Dragging cables over manhole frame edges, duct entrances, and ground or pavement surfaces.
 - (f) Exposure to pedestrian or vehicular traffic.
 - (g) Looping in and out of manholes to avoid splicing.
 - (h) Power pulling at locations other than at ends of cable.
 - (i) "Jerking" of cables caused by too weak rope that elongates under tension, exerts momentary sharp pull on cable, recovers, and elongates for another like cycle.
 - (j) Sheaves and pulleys that stop rolling during pull, due to inadequate support or lubrication.
 - (k) Inadequate sealing and mechanical protection of cable ends.
 - (l) Reel surface and edge damage from poor hoisting techniques.
 - (m) Pulling distances too great.

b. Installation Equipment. Major equipment items, required for installing cable in underground ducts, shall include the following:

- (1) Power winch.

- (2) Cable feed-in tubing guide capable of producing a uniform and rigid 3 and 4-foot and greater radius bend, and having a nominal diameter equal to that of the ducts.
- (3) Single pulleys or sheaves providing a minimum cable bending radius (not overall sheave radius) of 10 times the largest cable diameter. Such sheaves shall be used for minor cable bends within "through cable" manholes and at feed-in manhole rims (if necessary). Sheaves shall have ball or roller bearings.
- (4) Adjustable gang pulleys with three or more pulleys capable of producing up to a 4-foot smooth cable bending radius. Each pulley shall have minimum cable bending radius of 10 times the largest cable diameter.
- (5) Lubrication equipment to pre-lubricate ducts, cables at guide-in tubing, and cables at intermediate pull-through manholes.
- (6) Cable reel support equipment including stands, arbor, and braking mechanism.
- (7) Dynamometer for measuring pulling tensions.
- (8) Communications equipment.
- (9) Pulling ropes or cords having the following characteristics:
 - (a) A working strength at least equal to the maximum allowable cable tensions as specified herein. "Working strength" is normally 10 to 14 percent of published rope "breaking strength".
 - (b) Rope or cord shall be a twisted or braided synthetic fiber unaffected by water and having a low level of elongation under load. Material shall have a texture non-injurious to plastic duct when pulled against bends. Wire rope, if proposed, shall have a smooth and rigidly adhering synthetic material covering.
 - (c) All pulling ropes or cords shall have swivel devices at cable attachment ends.
- (10) Cable lubricant specifically manufactured for electrical and control (telephone) cables. Do not use soap lubricants or those containing soap which are harmful to polyethylene- sheathed cables.
- (11) Cable pulling devices (secured to ends of cable as specified below).

c. Cable Pulling Devices.

- (1) Pulling devices for securing cable to pulling rope shall be factory-installed pulling eyes, field-installed pulling eyes, or basket weave cable grips. All shall be provided with integral or separate swivels.
- (2) Factory-installed pulling eyes necessitate that each cable pulling segment be cut to length by the cable manufacturer. Greater tensions and longer pulling lengths can be used with factory pulling eyes for straight duct bank segments.

- (3) Field-installed pulling eyes for control cable shall be a 4-crimp series, sized to the cable. Power cable pulling eyes shall be a type secured to conductors and approved by the Resident Engineer.
 - (4) Basket weave cable pulling grips shall be carefully sized to the specific diameters of the cables to be installed. Use grips with a rotating eye feature for power and control (telephone) cables.
- d. Duct Cleanout and Pre-Lubrication.
- (1) If any new or existing underground duct or conduit displays any evidence of contamination by soil or other foreign matter, such ducts or conduit shall be cleaned with a stiff bristle brush, swabbed, and flushed clean with water under pressure, before proceeding with cable pulling operations. Even a minor amount of soil or sediment in the bottom area of a duct will greatly increase the coefficient of friction and pulling tension required. With soil contamination, cable lubricant is of little value. Therefore, it is of utmost importance that conduit be cleaned prior to installation of cable.
 - (2) It is the contractor's responsibility to determine whether ducts designated for occupancy should be cleaned. The contractor shall assume complete responsibility for any difficulties or damage to the cable in placing cable in ducts.
 - (3) In addition to cable lubrication as specified elsewhere, all ducts to receive cables under this contract, shall be pre-lubricated using the same lubricant as for cables. Lubrication shall be thoroughly applied with applicators designed for this purpose. Lubrication on cable only, will rub off to a large degree, especially at duct bank offsets at manholes.
- e. Setting Up Cable Reels and Apparatus.
- (1) The contractor shall inspect cable reels for flange protrusions which could damage the cable sheath. Also, the contractor shall inspect for any obstructions that could interfere with proper unwinding of the cable.
 - (2) Careful control shall be exercised in the movement of cable reels. Where it is necessary to roll a reel to a desired location, it shall be rolled in the direction indicated by the arrows painted on the reel flanges. The reel shall not be allowed to tilt. A substantial runway of heavy planks should be employed where uneven ground conditions exist that may cause the reel to tilt. Where it is necessary to move a reel of cable with heavy equipment, a cable reel sling or equivalent should be used.
 - (3) In conduit sections containing curves, the cable reel shall be set up at the manhole near the curve unless other conditions do not permit.
 - (4) Cable reels shall be set up on the same side of the manhole as the conduit section in which the cable is to be placed. The reel shall be made level and brought into proper alignment with the conduit section so that the cable may be passed from the top of the reel in a long smooth bend at maximum radius into the duct without twisting and making more than a 90-degree bend. This is of utmost importance in handling filled

type cable in temperature ranges of 35°F and lower. Under no circumstances shall the cable be pulled from the bottom of a reel.

- (5) It is essential that the cable reel be in proper alignment and level during the placing operation. Incorrect location of the reel will cause unnecessary binding which will result in uneven cable feed.
 - (6) Do not permit adjacent turns of cable on the reel to stick together and cause binding as the cable is payed off the reel. Feed the cable by rotating the reel manually.
 - (7) Other cable support equipment, such as pulleys, sheaves, and gang-pulley equipment shall be set up rigidly within intermediate manholes to smoothly guide cables to exiting ducts.
- f. Attaching Pulling Grips. All pulling grips shall be stretched onto the cables such that the entire lengths of the grip woven material will exert tension on the cable, thereby distributing stress. If the end of any cable grip (furthest from the cable end) does not grip as tightly as the lead end, secure same to cable with a steel banding. Inspect cable grips frequently, and the first pull of control (telephone) cable in particular (in the first intermediate manhole), to ascertain that this requirement is fulfilled. If any uneven gripping is evident, banding will be required for all remaining cable installation of the applicable cable type and size.
- g. Feeding and Pulling Cable.
- (1) All cable shall be installed using methods that will prevent excessive and harmful stretching, twisting, and flexing of the cable. Such damaging treatment will mechanically weaken the cable and destroy the electrical properties immediately or in a short time.
 - (2) Cable may be pulled by hand or power winch. Pull rope shall be attached to cables with pulling eye or basket weave pulling grips (all equipped with swivels) for each cable pulled. Do not exceed maximum allowable pulling tension as hereinafter specified. Do not use cable manufacturer's maximum pulling tensions except for cable factory-installed pulling eyes.
 - (3) All splices shall occur in manholes only. Splices shall not be pulled into ducts or manholes.
 - (4) Cable feed-in tubing guide, same size as conduit, of suitable length shall be secured in the manhole between the cable reel and the face of the duct to protect the cable and guide it at the maximum possible smooth radius into the duct as it is payed off the reel.
 - (5) A cable lubricator (funnel) shall be placed around the cable just ahead of the cable feed-in guide to facilitate lubrication of the cable. The quantity of lubricant shall conform to the lubricant manufacturer's recommendations.
 - (6) Before starting to pull, check the equipment carefully to make sure that it is properly set up in order to minimize the chance of interruption once pulling has started. Tension shall be kept on both the cable reel and the pulling line at the start of the pull. Excessive slack and the twist of the pulling line may cause the connecting links to turn and catch in the duct.

As far as possible, the cable shall be pulled in without stopping. A pulling speed of 80 to 100 feet per minute is recommended to minimize friction forces.

- (7) A person experienced with cable handling shall be posted continuously at the cable reel while pulling cable. In addition to braking the reels and observing cable lubrication, he shall carefully inspect cable paying off the reel for cable sheath and other defects. If defects are noticed, the pulling operation shall be stopped immediately and the Resident Engineer promptly notified of the defect. Kinks and/or irregularities in the cable sheath shall be removed or corrected as directed by the Resident Engineer.
- (8) Careful attention shall be paid to signals from the installation crew as the cable is being pulled so that pulling may be stopped instantly whenever necessary to avoid damage to the cable.
- (9) If for any reason the pulling operation is halted between manholes, the winch operator shall not release the tension on the winch unless directed to do so. In restarting the pulling operation, the inertia of the cable shall be overcome by gradually increasing the tension in steps a few seconds apart until the cable once again is in motion.
- (10) The leading end of the cable at intermediate manholes shall be guided into the duct and a feeder tube nozzle placed around the cable to prevent the cable from rubbing on the edge of the duct.
- (11) All pulled ends shall be examined for evidence of damage due to the pulling operation. The cable sheath shall not be pulled beyond the cable core. Notify the Resident Engineer for inspection, and for repair or replacement action that must be taken where cracks or openings are found in the cable sheath following the pulling operations.
- (12) Cable ends shall be kept sealed at all times using REA-approved cable end caps and electrical tape. After the cable has been placed, the exposed cable in the manholes should be wiped clean of cable lubricant with a cloth before leaving the manhole.
- (13) All individual cable segments shall be pulled in one direction only. Both ends of a cut cable segment shall not be introduced into an intermediate manhole and pulled in two different directions. Also, no cable segments shall be pulled out of any manhole and introduced into the same manhole for a continuation of a cable segment pull. These unacceptable pulling practices, used to avoid splicing, result in abrasion from dragging over ground surfaces and manhole frame, exposure to pedestrian and vehicular traffic, damage to cable layers from twisting and small bending radii when pulling cable loops through manhole frame. Shields of cables so pulled are almost always damaged.
- (14) Sidewall cable pressure from duct bends, feed-in tubes, and pulleys, frequently govern the length of cable that can be pulled. The greater the radii, the less the sidewall pressure. Therefore, the contractor shall use the maximum radius at every manhole where a 90-degree pull is permitted. Adjustable gang pulleys with three or more pulleys shall be used for horizontal bends in manholes. Individual pulleys within the

gang pulley device shall have a cable bending radius of minimum 10 times outside diameter of largest cable to be pulled. Width of pulleys shall be adequate to support the cable group to be pulled. Adjust gang pulleys to produce a smooth 90 degree curvature bend where such changes in direction occur.

- (15) If cables will be spliced in a manhole where duct banks enter and leave 90 degrees apart, separate cable segments shall be introduced into the manhole and pulled in different directions unless pulling is permitted around a horizontal gang pulley within the manhole.
- (16) Where more than one cable will be installed in a single duct, all shall be pulled into the duct concurrently.
- h. Cable Spoil. All cable pulling ends shall be trimmed back to remove cable material always damaged by pulling eyes or basket weave pulling grips. To remove such spoil, cut each cable off a distance from the end equal to three times the length of pulling eye or twice the length of the basket weave pulling grip as a minimum. These amounts shall be cut off for all cables including those to be spliced or terminated by others.
- i. Use of Dynamometer.
 - (1) The dynamometer shall be accurately calibrated and secured to properly indicate tension exerted on the cable. The dynamo-meter reading will usually give the resultant force exerted on the anchoring device, which shall be converted to the horizontal component to give correct value of pulling tension.
 - (2) Dynamometer readings shall be made only in the presence of the Resident Engineer. If any pulling tension is approaching the maximum allowable, and if in the judgment of the Resident Engineer, the allowable will be appreciably exceeded for the proposed run, pulling operations shall be immediately stopped, and the cable run spliced in the preceding manhole.
- j. Maximum Cable Pulling Tensions. Maximum allowable cable pulling tensions, as measured by dynamometer, shall not exceed the following values for single cables. For multiple cables, add the tension values for the number of cables being pulled. Use a pulling rope having a working strength [not breaking strength -- reference subsection 16F.4b(9)] at least equal to the "maximum allowable pulling tension" values below.

<u>Cable</u>	<u>Maximum Allowable Pulling Tension (lbs)</u>
1-1/C #8	125
1-1/C #6	200
1-1/C #4	325
1/1-C #2	500
1-6 PR #19	125
1-12 PR #19	250
1-25 PR #19	500

- k. Separation of Cables Installed in Conduit or Duct.
 - (1) Power cables of the same voltage may be installed in the same duct.

- (2) Power cables of less than 600 volts may be installed in the same duct.
- (3) Power cables of less than 600 volts shall not be installed in the same duct with control, telephone, or coaxial type cables.
- (4) Power cables of more than 600 volts shall not be installed in the same duct with control, telephone, coaxial, or power cables of less than 600 volts.
- (5) Control, telephone, and coaxial cables may be installed in the same duct.

I. Cable Installation in Manholes or Handholes.

- (1) Power and control cables shall be installed in separate manholes or handholes unless otherwise specified. If installed in same manhole, install power and control cables on opposite sides. At splice locations, use cable racks at different elevations to separate power and control cables.
- (2) Cable racking surplus shall be pulled back by hand into intermediate manholes. Pull surplus one manhole at a time beginning near both ends of cable segment. Do not use power winch unless permitted by the Resident Engineer.
- (3) Cables shall be carefully routed around manhole interiors, taking all necessary precautions to prevent sharp bending. Cable racks shall be plastic or galvanized steel with properly sized porcelain insulators for the latter. Fasten all cables to plastic racks with nylon ties and to steel racks by means of the insulators.
- (4) Where a splice occurs, cable shall make one loop around the manhole, and the splice located near the center of the loop.
- (5) Where power and control cables are installed in the same manhole, the entire exposed length of all power and control (telephone) cables shall be fireproofed by applying fire and arc proofing tape per Paragraph 16A.23 above.

16F.5 CABLE TAGGING.

- a. All cables shall be tagged in each manhole and in each terminal cabinet with not less than two tags per cable, one near each duct entrance hole. Tags shall be attached to cables immediately after installation of each cable.
- b. Tags shall be circular in shape and 2 inches in diameter. Material shall be minimum 0.020-inch thick copper or brass or 0.0625-inch thick lead. 1/4-inch high steel lettering dies or equivalent size engraving equipment shall be used to make the tags. Tags shall be secured firmly to cables with Number 14 AWG copper wire.
- c. Tag markings shall consist of an abbreviation of the facility served by the cable and the letter "P" or "C" denoting power or control. The facility shall include the applicable runway. Where like multiple control cables are routed between the same facilities, further identify such cables throughout the run with a single-digit number following the letter "C". All individual-conductor power

circuits shall be bundled under the same tag as opposed to separate tags for each conductor.

16F.6 SPLICING.

a. General Requirements.

- (1) Splices shall be performed only by experienced and qualified cable splicers regularly engaged in this type of work.
- (2) Cable armor and/or shielding shall be bonded together across splices to provide continuous electrical paths.
- (3) Where a cable is cut preparatory to splicing, the work shall proceed without delay. When an unavoidable delay is encountered in completing a splice, the opened cable shall be protected to prevent the entrance of moisture and foreign matter.
- (4) Any splicing material (such as resin) older than the do-not-use-after date on the package, shall be replaced with new material at the contractor's expense.
- (5) Unless otherwise specified, where multiple runs of single-conductor underground power cables are spliced, each single-conductor cable shall be spliced in a separate envelope.
- (6) Approved stress reduction methods shall be used in splicing all shielded high voltage power cables (5KV and higher voltage).

b. Underground Power Cable Splices (600 Volts or Less). All low voltage splices shall be encapsulated in pressure resin in clear plastic envelopes, except as otherwise specified in Paragraph 13A.6 above, on drawings, or in special specifications. All low voltage splices shall be made with compression connectors specified in Paragraph 13A.6 above, except as otherwise specified on drawings and in special specifications.

c. Underground Control (Telephone Cable) Splices.

- (1) Kit and Resin. The splices shall consist of a rigid polypropylene mold body with a built-in spacer web to provide cable centering and proper compound coverage. The mold body shall be filled with a flexible polyurethane electrical compound capable of continuous operation at 90 °C, with an emergency overload temperature rating of 130°C. Splices must have provisions for inline splicing of shielded or non-shielded plastic or rubber-jacketed control (telephone) cables. The splices shall be rated for direct burial applications. For control cables with outside diameters between 0.25 inches and 3.25 inches, 3M Scotchcast Signal and Control Cable Inline Splicing kits of the 72N series are approved, as they are among kits which meet specifications.
- (2) Connectors. Control cable splice connectors shall be in-line type, in which two conductors are spliced by laying one conductor in each end of the connector, and crimping the connector with a special tool selected to match the connector type and size. Before crimping, the connector is open on one side of its length. After crimping, the connector is closed all around its length. The connector bodies shall be made with a tin-plated phosphor bronze piece on the inside, to contact the cable conductors,

and bonded polyester insulation on the outside, to insulate the connection. The insulation shall be color coded to denote wire size range. The cable splice connectors and tools shall incorporate the insulation displacement termination technique which uses a slotted, tin-plated contact to displace the conductor insulation, thus providing four redundant electrical contact points. Connectors which require prestripping the conductor shall not be used. AMP, Inc. (Harrisburg, PA) Picabond connectors sized for conductor size, and matching AMP tooling, are among products meeting the above specifications, and are approved.

- d. Submittals. See Paragraph 1A.4 above. If the contractor --
- (1) Intends to splice using materials different from those specified in Paragraphs b and c above, or
 - (2) Intends to splice a 5KV or higher voltage power cable,
- then the contractor shall submit to the Contracting Officer, shop drawings or catalog cuts for all splicing materials, tools, and dies. The contractor shall splice no cables before he has received the Contracting Officer's approval of these items.

16F.7 CONTROL (TELEPHONE) CABLE TERMINATIONS.

- a. Cable Routing and Support.
- (1) Cable jackets shall be removed within terminating enclosures such that no more than 2 inches of jacket material is visible within the enclosures. Ground shielding and armor as specified below.
 - (2) Exposed cable conductor bundles shall be lock-stitched laced together with nylon lacing twine spaced at approximate 5/8- inch intervals. Each bundle shall contain maximum 25 pairs of conductors which shall be neatly routed and secured to backing panels with nylon clamps.
- b. Cable Pair Terminations.
- (1) Terminated pairs shall have the same sequence on each terminal strip. (For terminal block specifications, see Paragraph 16A.19, above.) The color code termination sequence on the terminal strips shall be in accordance with the following schedule. The white mates shall start at the top or left-hand side of the terminal block with color continuing down or across the block according to the following schedule:

MATE COLORS

PRIMARY WIRE COLORS

WHITE	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
RED	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
BLACK	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
YELLOW	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
VIOLET	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE

- (2) When cables do not have the preceding color code, like pairs shall be terminated in the same sequence at both ends of the cable.

16F.8 CABLE ARMOR AND SHIELD GROUNDING.

a. Grounding Locations.

- (1) Control cable armor and/or shielding shall be grounded at one end of each cable run only.
- (2) Power cable armor shall be grounded at both ends of each cable run.
- (3) Shielding and armor of control and power cables shall not be grounded at splice locations.

b. Grounding Procedures.

- (1) Use #14 AWG stranded copper grounding conductors for grounding shielding and armor. Secure grounding conductors to shielding and armor by using UL-approved grounding connectors specifically designed for this purpose. Neatly tape ends of butted cable to conceal the connections.
- (2) Attach crimp-type lugs of proper size to free ends of grounding conductors, and secure lugs to enclosure interior wall with a machine screw and nut.

16F.9 CABLE TESTING.

a. General Requirements.

- (1) Both before and after installation, all contractor-furnished and Government-furnished power and control (telephone) cables shall be tested as required herein. Testing after installation shall be accomplished across splices.
- (2) All testing shall be accomplished in the presence of the Resident Engineer. Furnish two signed and dated copies of all test results, clearly tabulated for all segments of cable tested, to the Resident Engineer.
- (3) The contractor shall use his own test equipment, which shall bear current calibration certification from a certified instrument calibration laboratory.
- (4) Any measured values not conforming to specified values shall be cause for rejection of the defective cable installation. After repair or replacement, if so required by the Resident Engineer, cable shall be retested and additional remedial work performed until satisfactory test results are obtained. All repair and replacement work shall be accomplished at no additional cost to the Government.

b. 600-Volt Power Cable Testing.

- (1) Conductor continuity shall test positive.
- (2) Armor continuity shall test positive.
- (3) Dielectric strength/insulation resistance shall test 50 megohms minimum at 500 volts D.C. between the following:
 - (a) Conductor and ground for single-conductor cable.
 - (b) Individual conductors for multi-conductor armored cable.
 - (c) Individual conductors and grounded armor.

c. Control (Telephone) Cable Testing.

- (1) Conductor continuity shall test positive.
- (2) Shield continuity shall test positive.
- (3) Armor continuity shall test positive.
- (4) Dielectric strength/insulation resistance shall test 50 megohms minimum at 500 volts D.C. between paired conductors and between individual conductors and grounded shield.
- (5) After installing control cable, the minimum number of acceptable paired conductors shall comply with the following:
 - (a) For 11 pair or less cable, all pairs shall test acceptable.
 - (b) For 12 to 25 pair cable, all pairs except one shall test acceptable.

SPECIFICATIONS SUPPLEMENTAL TO SPECIFICATIONS FAA-GL-840B AND FAA-GL-918C

10/28/03

1. Contractor-Furnished Frangible Couplings. The following specifications supersede Paragraph 16A.20 of Specification FAA-GL-918C. The Contractor shall furnish all the frangible couplings to be applied under this contract. All frangible couplings shall be 2"-diameter cast aluminum couplings having hexagonal clamping ring. The coupling shall accommodate 2"-diameter EMT conduit. The frangible couplings shall meet the requirements of either Military Specification MS-17814-1, or of FAA Drawing C-6046. The straight-thread Multi-Electric Cat. No. 961-A frangible coupling is among couplings meeting MS-17814-1. The tapered-thread Multi-Electric Cat. No. 961-AT frangible coupling is among couplings conforming to FAA Drawing C-6046. If the Contractor intends to furnish substitute frangible couplings, the Contractor shall submit to the Contracting Officer, catalog cuts demonstrating that the substitute couplings meet the above specifications. The Contractor shall furnish at least 110 each of the frangible couplings. The Contractor shall turn all spare frangible couplings over to the Resident Engineer, who will deliver them to FAA maintenance personnel.
2. MALS PAR-38 Lamps.
 - A. Specifications. The following specifications override Paragraph 13A.5. The Contractor shall furnish fifty-five PAR-38 halogen incandescent spot lamps. The lamps shall be rated by the manufacturer to have 120-watt power, approximately 1900 lumens and 25000 center beam candlepower (CBCP), and 3000 hours average lamp life at 120 volts. Sylvania lamps of lamp designation 120PAR/CAP/SPL/SP and NAED (Vendor I.D. No.) code 14856 meet these specifications. If the Contractor intends to furnish lamps other than Sylvania No. 14856, the Contractor shall submit to the Contracting Officer the substitute lamp's candlepower distribution curve and manufacturer's technical data sheets demonstrating that the substitute meets the power, brightness, and lamp life and lumen maintenance criteria of the above specifications. The contractor shall also furnish a sample lamp, and shall demonstrate that it will fit the lamp aiming device supplied with the MALSR.
 - B. Application. The Contractor shall install 45 of these lamps on the 5-light bar structures. The remaining 10 lamps shall be delivered to the Resident Engineer for use as spares. The installed lamps shall be aimed vertically to the aiming angles specified on the drawings.
3. CONTROL CABLE SHIELD GROUNDING. Control cable shield shall be grounded at each end of each cable run. This requirement overrides Specification FAA-GL-918C, Paragraph 16F.8a(1) and Specification FAA-GL-840B, Paragraph 16F.8a(1).
4. SUPPLEMENTAL LIGHTNING ARRESTER. If lightning arresters are not furnished with the MALSR equipment, or supplemental lightning arresters are required, the lightning arresters shall meet the following specifications:

Added 1/8/2013

- A. Voltage rating: 120/240 VAC, 3 wire, 1 phase, 50/60Hz.
 Each L (black wire) to N (neutral wire) 120 VAC.
 L (black wire) to L (black wire) 240VAC.
- B. Conduction starts @ 240V peak.
- C. Operation: Bipolar, same performance on either polarity of surge.
- D. Power consumption: None
- E. Power follow current: None
- F. Load or source KVA: Unlimited.
- G. Temperature range: -50°C to +80°C.
- H. Response: Less than one nanosecond.
- I. Extreme lightning and surge duty: 55 KVA each line to ground.
- J. Discharge voltage vs. surge current, each line to ground:

@	1.5 KA, 8x20us	420V peak
	5.0	520
	10.0	550
	20.0	700
	30.0	825
	50.0	970

- K. Life, each line to ground:

@	1.5KA, 8x20us	60,000 operations
	5.0	3,000
	10.0	300
	20.0	50
	30.0	15
	50.0	5

Lightning and electrical surge arrester Model LPC 10262-6 from Lightning Protection Corporation (Goleta, CA) meets the above specifications.

- 5. Fluorescent Light Fixtures and Ballasts. The following specifications supersede Paragraph 16A.17f of Specification FAA-GL-918C.

- f. Interior Light Fixture and Lamps. Each interior light fixture shall be a surface-mounted, 120-volt, fluorescent light fixture having a high-gloss white painted steel chassis and a light-controlling acrylic lens enclosure. The lens (diffuser, refractor) enclosure shall be of a wraparound style that illuminates the ceiling as well as the room. The enclosure shall be hinged on one side, or shall pull down, for cleaning and maintenance. The fixture shall be nominally four feet long, and shall accommodate two 48"-long T-8 fluorescent lamp tubes. The ballast shall have a radio frequency suppressor. The ballast shall operate normally at temperatures above 20°F. The lamp tubes shall be 32-watt 48"-long T-8 fluorescent lamp tubes, each with an initial rating of 2,850 lumens. The following 32-watt lamp tubes are among lamps which meet these specifications: General Electric Trimline, Philips TL70, and Sylvania Octron. The following light fixtures are among fixtures that meet the above specifications.

- (1) Day-Brite Cat. No. HWN232-120-1/2-EB, with:

- (a) Valmont Electric Cat. No. E232-P1 120 G01 two-lamp electronic ballast, rated at zero degrees F., and
 - (b) Valmont Electric Cat. No. 89G635RFI filter.
- (2) Holophane Model No. HW-S-M-4-D-S-H71-042-LP-1-1 with RF suppressor
 - (3) Lithonia Model No. WA-2-32-120-GEB-RIF1
 - (4) Metalux Cat. No. W-232A-120-LEOC8-RIF1

If the contractor desires to furnish and install other light fixtures than those listed above, or a tandem connected and wired version of the 4'-long fixture listed above, the contractor shall submit catalog cuts of the fixture, and receive the Contracting Officer's approval before procuring.

- 6. NO ASBESTOS. No material containing asbestos shall be installed under this contract.
- 7. GROUNDING ELECTRODE. The following specifications supersede Paragraph 16A.4c of Specification FAA-GL-918C.
 - c. Grounding Electrode. Grounding electrodes (rods) shall be copper clad steel, 3/4-inch by 10 feet, except where otherwise specified. The top of the grounding electrode shall be a minimum of 12 inches below finished grade. Conductors shall be attached to electrodes with exothermic welds only, except where fire or explosion hazards exist, as near existing fuel tanks. Where such hazards exist, hydraulically crimped connections will be permitted as specified below.
- 8. ELECTRODE GROUND TESTING. The following specifications supersede Paragraph 16A.4h of Specification FAA-GL-918C.
 - h. Testing. Electrode grounds shall be tested for resistance at each location. Resistance to ground for each grounding location shall be 10 ohms or less. If this value is not achieved with the grounding electrodes as shown on the drawings, additional grounding electrodes spaced at least 6 feet apart, or electrode extensions of the same construction and diameter, shall be installed until the resistance value does not exceed the maximum of 10 ohms. A tabulated report of the final resistance value at each location shall be provided to the Resident Engineer.
- 9. AIR TERMINAL BRACE. The following specifications supersede Paragraph 16A.18c of Specification FAA-GL-918C.
 - c. Air Terminal Brace Assembly. The air terminal brace assembly for a 36" air terminal shall be a 24"-long galvanized tripod assembly, with legs adjustable to accommodate any roof slope. Cat. No. 82 meets these specifications.
- 10. GROUND ROD CLAMPS. Paragraph 16A.18k, Ground Rod Clamps, of Specification FAA-GL-918C, is deleted.
- 11. CONTROL CABLE. The following specifications supplement Paragraph 16E of Specification FAA-GL-918C.
 - Specification. Control cable shall be either:

- REA Specification PE-39 cable meeting all the requirements of Section 16E, or
- REA Specification PE-89 cable (having foamed polyethylene or propylene conductor insulation with a solid skin of the same material), meeting all requirements of Specification FAA-GL-918C Section 16E except the REA Specification PE-39 requirements.

12. FACILITY AC SURGE ARRESTER.

The following paragraph supersedes Paragraph 16A.16d of Specification FAA-GL-918C.

- d. Arrester Meeting Specifications. For 120/240V, single phase, 60Hz applications, the Lightning Protection Corporation (Goleta, California) Model No. LPC 20206-7 AC surge arrester is one of the products that meet the above specifications. This arrester must be equipped with two Class J fuses, 60 amp, time-delay, 200KAIC (interrupting capacity), UL listed. If the contractor intends to furnish a substitute, or if a different power configuration must be accommodated, the contractor shall submit to the Contracting Officer, full manufacturer's literature on the substitute arrester, and shall not procure the substitute before receiving the Contracting Officer's approval. See Paragraph 1A.4 above.

The following paragraph is added to Paragraph 16A.16e of Specification FAA-GL-918C.

- (4) Fuses. The surge arrester must be equipped with two Class J fuses, 60 amp, time-delay, 200KAIC (interrupting capacity), UL listed.

13. PAPI PLATE. The following paragraph supplements and supersedes Paragraph 13D.2 of Specification FAA-GL-918C.

13D.2 SCREW ANCHOR FOUNDATION DESIGN AND USAGE. On drawings, screw anchor foundations are also called screw-in foundations and screw-in-anchor foundations.

- a. Screw Anchor Foundations. The two most frequently used screw anchor foundations, are shown on Figures 1 and 2 at the end of this section. The Figure 1 foundation is commonly used for ILS, RVR, MALSR, and PAPI facilities. The Figure 2 foundation is commonly used for REIL facilities. A. B. Chance foundations, Cat. Nos. T112-0262 and T112-0676, are among the products that meet the requirements of Figures 1 and 2, respectively. These items are also known by Cat. Nos. CT112-0262, CT112-0676. The Chance Figure 1 foundation is known as an "Instant" foundation (formerly known as a streetlight foundation).
- b. PAPI Plate. The PAPI plate of Figure 3 in Specification FAA-GL-918C does not describe the current A. B. Chance PAPI plate, Chance Cat. No. T112-0337 or CT112-0337. Figure 3 has a 26.65" dimension, and describes the old PAPI plate, which accommodated the AVW PAPI. The current (2002) PAPI plate, Chance Cat. No. T112-0337 or CT112-0337, has a 28" dimension in place of the 26.65" dimension. The current A.B. Chance PAPI plate is shown on A. B. Chance Drawing No. SA112-0337,

Rev C dated 07-08-93, and accommodates the NBP PAPI, Type FA-10620, NSN 8200-00-600-82751.

14. STEEL SIDING. The following paragraph supplements and supersedes Paragraph 13E.8 of Specification FAA-GL-918C.

13E.8 STEEL SIDING. Furnish and install steel siding panels and accessories in accordance with manufacturer's instructions and the following material specifications.

- a. Steel Sheet and Coating. The siding is made from roll formed 0.0172 inch (nominal) thick hot-dipped galvanized steel complying with ASTM A653 and having minimum yield and ultimate strength of 33,000 and 55,000 psi respectively. The coating is polyvinyl chloride, 4 mils dry film thickness. Unless otherwise specified on the drawings, the outside finish color is white.
- b. Siding Meeting Specifications. Coated steel siding by Rollex Corporation, Elk Grove Village, Illinois is among products meeting these specifications. Substitutes require submittals per Paragraph 1A.4 above.

15. BURIED GUARD WIRE.

The following paragraph supplements and supersedes Paragraph 16A.4e of Specification FAA-GL-918C.

- e. Buried Guard Wire. Buried cables (including armored cables) not completely enclosed in ferrous conduit, shall be protected by a bare copper guard wire. Unless specified otherwise, or shown otherwise on the drawings, the guard wire shall be #1/0 AWG. Embed the guard wire in the soil at least 10 inches directly above and parallel to the cables being protected. Where the width of the run of cables or ducts does not exceed 3 feet, install one guard wire centered over the cable or duct run. Where the cable or duct run is more than 3 feet wide, install two guard wires. Space the two guard wires at least 12 inches apart, and 12 to 18 inches inside the outermost wires or outermost edges of the duct. Weld the guard wire exothermically to a grounding electrode at each end, and to grounding electrodes at approximately 90-foot intervals. The spacing between the grounding electrodes shall vary by 10 to 20 percent, to prevent resonance.

The following paragraph supplements and supersedes Paragraph 16F.3f of Specification FAA-GL-918C.

- f. Buried Guard Wire. Unless specified otherwise, all direct-earth burial power, control, and coaxial cables shall include the installation of #1/0 bare copper ground wire per Paragraph 16A.4e above.

16. PAR-38 LAMPHOLDER SOCKET RETENTION SCREWS. If DME Corp. MALSR equipment is furnished by either the FAA or the contractor, the contractor shall inspect the PAR-38 lampholders. It is probable that the heads of the socket retention screws furnished with the lampholders are too wide to fit into the socket recesses. If they are, the contractor shall furnish stainless steel 6-32 x 1 1/4" socket head cap screws to

install the sockets in the lampholders. Two cap screws are required per PAR-38 lampholder.

BASIC ELECTRICAL REQUIREMENTS FOR FAA RELOCATIONS (16010)

PART 8 GENERAL

8.01 SECTION INCLUDES:

- A. Work under this Section is subject to the requirements of the Contract Documents.
- B. Apparatus, appliance, material or work not shown on the Drawings, but mentioned in the Specifications, or vice versa, or any accessories necessary to make the work complete and ready for operation without additional expense to the contract.
- C. The Contractor must furnish, erect, install, connect, clean, adjust, test and condition all manufactured articles, materials and equipment, and place in service in accordance with the manufacturer's directions and recommendations except as otherwise noted on the Drawing or specified herein.

8.02 RELATED WORK:

- A. As specified in the following special provisions:
 - 1. Fiber Optic Cable and Equipment for FAA Relocations (Section 16125)
 - 2. Installation of Underground Cable for Airports (Section L-108)
 - 3. Installation of Airport Underground Electrical Duct (Section L-110)
 - 4. Electrical Manholes and Handholes for FAA Relocations (Section L-115)
 - 5. CED/FAA Communication MH/HH As-Built Checklist (Section L-118)

8.03 REFERENCES:

- A. Materials and installation must comply with all codes, laws and ordinances of Federal, State and local governing bodies having jurisdiction.
- B. In every installation where regulations of electric and/or telephone companies apply, conformance with their regulations must be mandatory and any costs incurred must be included in the Contract.
- C. In case of differences between building codes, State and Federal laws, local ordinances and utility company regulations and the Contract Documents, the most stringent must apply.
- D. All design, equipment and materials specified must conform to all acts, laws,

rules and regulation of the following organizations:

1. City of Chicago Electrical Code (CEC) must take jurisdictional precedence over all other authoritative bodies.
 2. National Electrical Code (NEC) (ANSI/NFPA 70).
 3. National Electrical Safety Code (NESC-ANSI C2).
 4. American National Standards Institute (ANSI).
 5. National Fire Protection Association (NFPA).
 6. Institute of Electrical and Electronics Engineers (IEEE).
 7. Insulated Cable Engineers Association (ICEA).
 8. National Electrical Manufacturers Association (NECA).
 9. Illuminating Engineering Society (IES).
 10. Underwriters Laboratories, Inc. (UL)
 11. Canadian Standards Association (CSA).
 12. Occupational Safety and Health Administration (OSHA).
 13. Americans with Disabilities Act (ADA).
 14. International Association of Electrical Inspectors (IAEI)
SOARES – Book on Grounding.
 15. International Electrical Testing Association (NETA)
NETA – ATS- Acceptance Testing Specifications for
Electrical Power Distribution Equipment and Systems.
- E. Should Work be performed which does not comply with the requirements of the applicable building codes, State and Federal laws, local ordinances, industry standards, utility company regulations and the Contract Documents changes for compliance must be done by the Contractor at no additional cost.
- F. The Contractor must secure and pay for all permits, governmental fees, taxes and licenses necessary for the proper execution and completion of the electrical work.
- G. The Contractor must submit to governmental agencies and utility companies Shop Drawings, which are required by these agencies, for their approval.
- H. The Contractor will notify the Engineer, CDA, and FAA of any materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction.
- 8.04 SUBMITTALS:
- A. The Contractor must submit Project data to the Engineer, CDA, and FAA prior to purchasing and installation. The data must include, but not be limited

to, the following:

1. Installation design Drawings - schematic, wiring, and one line diagrams; lighting panel schedules; lighting; conduit; duct banks; conduit and cable schedules; grounding; symbols and legends; etc. must be included.
2. Power system short circuit and coordination calculations. The calculations must be performed under the supervision of a Professional Engineer registered in the State of Illinois. The calculations must bear the stamp of the responsible Engineer.
3. The equipment manufacturers' schematic diagrams must be "JIC" ladder type. Schematics must identify all devices, wire codes, and terminal numbers.
4. The equipment manufacturers' wiring diagrams must show terminal blocks for external wiring. Wiring diagrams must identify all devices, wire codes, and terminal numbers.
5. The equipment manufacturers' internal point to point and external wiring diagrams between cubicles, panels and components within the equipment line up must be provided.
6. Catalog cuts and major electrical equipment manufacturers' Drawings must include, but are not limited to, relays, meters, current and potential transformers, disconnect switches, fuses, contactors, lighting and more.
7. Complete descriptive literature, performance and test data and rating data for all equipment must be provided.
8. Instruction books, Operation and Maintenance manuals with spare parts must be provided.
9. Complete and accurate "As Built" Drawings must be provided by the Contractor to the Engineer for verification and drafting.

B. Shop Drawings

1. The Contractor must submit Shop Drawings and Samples in accordance with the Contract Documents and supplementary requirements as stated under each Section of the Specifications.
2. The Contractor must make submittals in accordance with the approved Schedule before any material or equipment is purchased. The submittals must be reviewed by the Engineer, CDA, and FAA for compliance with the Contract Documents.
3. Shop Drawings must include manufacturers' names, catalog numbers, cuts, diagrams, schedules and other such descriptive data specifically prepared for the Work by the Contractor, Sub-contractor and/or manufacturer to illustrate that the materials, equipment or system

conform to the Contract requirements.

4. Additional submittal requirements are described in individual sections of the Specifications.
5. Any listed materials, fixtures, apparatus, or equipment that are not in accordance with the Contract Document requirements can and must be rejected for use in this Contract.
6. Any materials, fixtures, apparatus or equipment installed without reviewed and accepted submittals must be removed by the Contractor and replaced at the direction of the Engineer, CDA, and FAA and without additional cost.
7. Substitutions to listed acceptable manufacturers equipment and material must not be accepted until the Contractor has complied with the requirements in the specifications.

C. Installation Drawings

1. The initial copy of all installation Drawings must be submitted to the Engineer, CDA, and FAA for review.
2. The installation Drawings must be made under the direction and supervision of the Contractor and must show all electrical work including, but not limited to, conduit, wiring, electrical equipment and devices, lighting fixture locations and elevations, points where conduit enters or leaves structural slabs and walls, junction boxes, conduit supports and inserts. Symbol representation for home run circuits must not be acceptable. These Drawings must include all ductbank work, embedded conduit plans, electrical room layouts and elevations as well as all circuiting and locations of all electrical equipment.
3. In addition to the preparation and submittal of Shop Drawings for manufactured electrical equipment and materials, the Contractor must prepare and maintain in current status, a complete set of detailed, completely circuited, and dimensioned electrical construction Drawings for all electrical work included under this Contract. These Drawings must be made at the Contractors expense.
4. Shop Drawings for manufactured electrical equipment and materials, the Contractor must prepare and maintain in current status, a complete set of detailed, completely circuited, and dimensioned electrical construction Drawings for all electrical work included under this Contract. These Drawings must be made at the Contractor's expense.
5. No electrical work will begin until these installation Drawings are so drawn, and thereafter finally accepted by the Engineer, CDA, and FAA.
6. The complete electrical distribution system from the sources, including

each branch circuit panelboard, must be shown and dimensioned exactly as to be installed, with all feeders located on the installation Drawings. Major equipment, lighting controls and apparatus must be shown to scale and properly located.

7. The Contractor must provide a separate set of installation Drawings for the lighting system; a separate set of installation Drawings for the power and control; and a separate set of installation Drawings for the special systems.
8. The Contractor must provide a single line diagram describing the power distribution system. This diagram must include ratings for all equipment and cable sizes from the service connection to the 120 Volt lighting and distribution panels.
9. The installation Drawings must include floor plans and reflected ceiling plans with electrical layouts drawn at a scale (or scales) as required with a minimum scale of 1/8 inch equal 1'-0". It is intended that installation Drawings of each trade be the same scale(s) in order to permit respective plans to be superimposed upon all others of each trade.
10. In addition to the floor plans, the layouts of all congested areas such as mechanical and/or electrical equipment rooms, and all functionally critical areas must be drawn at a minimum scale of 1/4 inch equals 1'-0", and with all details of construction shown. Additional installation Drawings may be requested if in the opinion of the Engineer, CDA, and FAA they are required to properly coordinate the Project.
11. The installation Drawings must include schedules for all panelboards. Schedules must depict the bus arrangement of the panelboard, the size of all circuit breakers, the connected load on each breaker, and a description of the load and it's location.
12. The installation Drawings must indicate the electrical installation exactly as to be constructed and therefore must be periodically revised to reflect all changes inclusive of those required by the Engineer, CDA, and FAA, those which are or have been found necessary in the field, those which may be suggested by the Contractor and approved by the Engineer, CDA, and FAA, etc.
13. All installation Drawings must be made on 3 mil Mylar sheets of the same size and with the same border lines and title blocks as the Contract Drawings, with the Contractor's name added.
14. Revisions must be performed when considered necessary by the Engineer, CDA, and FAA or the Contractor in order to facilitate proper coordination.
15. The Contractor must be responsible for the coordination of electrical work with the work of all other trades and must, in preparing the

installation Drawings, continually check the work of all other trades (inclusive of that indicated by Shop Drawings) in order to avoid possible installation conflicts arising therefrom. It must be understood that the work shown on the installation Drawings has been so coordinated. In the event of conflicts or interferences that cannot be resolved in the field, the Contractor must request a written clarification from the Engineer, CDA, and FAA.

16. Upon completion, the initial installation Drawings, and all revised installation Drawings thereafter, must be dated and certified as having been fully coordinated by the Contractor. It must then be understood that the work shown thereupon is ready for construction.
 17. All installation Drawings must be made in accordance with an approved schedule, prepared by the Contractor, and arranged to coincide with actual construction in such a manner as to allow the latter work to proceed without delay.
 18. If, in the opinion of the Engineer, CDA, and FAA, the installation Drawings are in acceptable condition after each has been finally revised and accepted, the Contractor may submit same as the field record Drawings called for elsewhere in the Specifications.
 19. The Contractor must include wiring diagrams and schematic diagrams. Each schematic diagram must be "JIC" ladder type. Wire and terminal numbers must be shown on all schematic and wiring diagrams.
 20. The minimum drafting letter size must be 1/8 inch in height and must be block type lettering.
- D. The Contractor must submit test reports as described under this Contract.

8.05 QUALITY CONTROL:

- A. After all equipment, devices and raceways are installed and wires and cables are in place and connected to devices and equipment test the system for continuity, proper phase rotation, short circuit, improper grounds, and other defects. Testing must be in accordance manufacturers' recommendations and individual sections of this Specification.
- B. The Contractor must be responsible for protecting all equipment and systems against harmful exposures to, or accumulations of dust and moisture, flooding, corrosion or other forms of damage and must clean and restore damaged finishes as may be required to place installations in a "Like New" condition before acceptance by the Engineer, CDA, and FAA.

8.06 DELIVERY STORAGE AND HANDLING:

- A. Equipment and materials must be delivered to the site and stored in the original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.

1. Items subject to moisture damage must be stored in dry, heated spaces.
 2. Manufacturer's directions must be followed in the delivery, handling, storage, protection, installation and operation of all equipment and materials.
- B. The Contractor must coordinate with the Engineer, CDA, and FAA the movement of heavy machinery, equipment and heavy parts thereof brought into or onto the building or premises.
 - C. Conduit openings must be kept closed by means of plugs or caps to prevent the entrance of foreign matter.
 - D. The Contractor must cover all fixtures, equipment and apparatus as required to protect them against dirt, water, chemical, solar, or mechanical damage. The Contractor must also provide any supplementary heating and cooling required to prevent moisture and thermal damage.
 - E. Equipment must be inherently safe and moving parts must be covered with guards.
 - F. Equipment in storage having moving parts, which may be damaged or distorted by being idle, must be rotated or exercised periodically and all lubricants must be properly maintained.
 - G. Additional requirements are described in individual sections of these Specifications.
- 8.07 WARRANTIES AND GUARANTEES:
- A. Warranties are as required per the individual specifications for each pay item.
- 8.08 EXTRA MATERIALS AND SPARE PARTS:
- A. Where spare parts or extra materials are called for in any Specification Section they must be supplied.
 - B. The Contractor must turn over to the CDA all spare parts and extra materials in the original factory packaging.
 - C. The Contractor must supply spare parts as recommended by the various equipment manufacturers. These must be of the types and quantities shown in the Operation and Maintenance Manuals.
- 8.09 ENVIRONMENTAL REQUIREMENTS:
- A. See Specification P-156 for these requirements.
- 8.10 SPECIAL REQUIREMENTS:
- A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.
 - B. Coordination - Coordinate work of this Section with adjacent work of other

trades.

8.11 CONTRACT DRAWINGS:

- A. The Drawings are diagrammatic and/or home-run type which are intended to convey the scope of work and indicate the general arrangement and/or sizes of conduit, equipment, fixtures and other work included in the Contract.
- B. The location of items required by the Contract Documents are not definitely fixed by dimensions and are approximate only. The exact locations necessary to secure the best conditions and results must be determined at the site and will be subject to the review of the Engineer, CDA, and FAA.
- C. The Contractor must coordinate the location of the lighting fixtures, pull boxes, conduit racks, intercommunication speakers, etc. with the location of the mechanical equipment.
- D. The Contractor must lay out the Work, check Drawings of all trades to verify spaces in which Work must be installed, and maintain maximum headroom and space conditions at all points.
 - 1. Where headroom or space conditions appear inadequate, the Contractor will notify the Engineer, CDA, and FAA, in writing, before proceeding with installation.
 - 2. Any minor changes in the locations of equipment, fixtures, lighting fixtures, conduits, outlets, devices, etc., from those locations as shown on the Contract Drawings must be made without extra charge to the Contract. A minor change in location must be considered to be within 10 feet of the location as may be scaled from the Drawings for all interior work and within 25 feet for all exterior work.

8.12 EXECUTION, CORRELATION AND INTENT OF DOCUMENTS:

- A. Scaled measurements from Drawings will not be used to determine installation locations.

8.13 INSTRUCTIONS AND ADJUSTMENTS:

- A. Before Final Completion and before final Contract payment is made, the Contractor must demonstrate and explain to the Engineer, CDA, and FAA the function, operation and maintenance of all equipment and systems installed.
- B. The primary adjustments of the system(s) must be accomplished by the Contractor to the complete satisfaction of the Engineer, CDA, and FAA at the time of completion of the installation.
- C. Where required in individual sections of this Specification, the Contractor will arrange for training CDA and FAA personnel as specified.

8.14 OPERATING AND MAINTENANCE MANUAL:

- A. General - Assemble manuals to include definite and specific information and instructions on materials, apparatus, equipment and systems provided under

the Contract. Include only the latest standard commercial data.

1. Maintenance period to be represented by the manufacturers' maintenance data is five (5) years.
 2. Coordinate contents of manuals with the actual needs of the CDA's and FAA's staff.
- B. Contents - Include for each item the following data, as applicable, edited to include items specific to this Contract. Make data, including notations, completely legible - typewritten or printed.
1. Manufacturer's operating instructions, maintenance and repair manuals which set forth the manner of operation, precautions, care to be followed and periodic preventive maintenance requirements.
 2. Final accepted Shop Drawings, Product Data and catalog cuts, including final comments and responses.
 3. Printed Data - Manufacturer's original catalog cuts, brochures, operating and maintenance data.
 4. Manufacturer's recommended maintenance and cleaning procedures, methods and materials for exposed finish.
 5. Manufacturer's Specifications, including performance curves, wiring diagrams, and tabulation of sizes and identifying numbers.
 6. Complete and detailed material list and parts list and assembly drawing.
 7. Recommended inventory of spare parts and emergency parts and sources of purchase.
 8. Governing agency and manufacturer test certificates, permits and inspection reports, including pressure test, insurance inspections and approvals, and shop or field performance tests.
 9. Certified factory and field performance report as required by the Contract Documents
 10. Final compliance certificates as required by the Contract Documents.
 11. Manufacturer's guarantee or warranty as normally provided and as specifically required by the Contract Documents.
 12. An index of volumes, in each volume of multiple volume systems.
 13. An index in and for each volume. List and combine the literature, for each system, in the sequence of operation.
 14. Name, address and telephone numbers of or, Subcontractors, suppliers, and installers.
 15. Name, address and telephone number of manufacturer's nearest service representative.

16. Name, address and telephone number of nearest parts vendor and service agency.
 17. Anticipated date CDA or FAA assumes responsibility for maintenance.
 18. Description of system and component parts.
 19. Pre-operation check or inspection list.
 20. Procedures for starting, operating and stopping equipment.
 21. Post-operation check or shut down list.
 22. Inspection and adjustment procedures.
 23. Emergency operating instructions.
 24. Accepted test data.
 25. Maintenance schedules and procedures.
 26. One (1) copy of each wiring diagram.
 27. One (1) copy of each piping diagram.
 28. One (1) copy of each duct diagram.
 29. Manufacturer's parts list with catalog names, numbers and illustrations.
 30. An exploded view of each piece of the equipment with part designations.
 31. List of special tools and test equipment required for the operation, maintenance, adjustment, testings, and repair of the equipment, instructions and components. Include lubricants, fuels, identification systems, control sequences, hazards, start up, shut down, noise and vibration adjustments, safety procedures, economy and efficiency adjustments and effective energy utilization.
 32. Scale and corrosion control procedures.
 33. Dismantling and re-assembly instructions.
 34. Trouble shooting, repair instructions.
 35. Calibration procedures.
 36. Ordering information.
- C. Binding - Assemble each group of documents for materials, apparatus, equipment or systems in binders identified for the items covered. Organize the contents in binders as follows:
1. Group documents for each item in the order listed above for contents.
 2. Index group of documents for each item in accordance with the filing system of the Contract Specification format.

3. Fold Drawings and other documents larger than 8-1/2" x 11" to properly fit in binders so that they can be fully unfolded without removal from the binder. Reinforce edges of large Drawings.
4. Provide each binder with a Table of Contents.

8.15 BINDERS:

- A. General - Hard-cover, three-hole, D-ring, loose leaf binders of size using standard 8-1/2" x 11" sheets. Binding is subject to the approval of the Engineer, CDA, and FAA.
- B. Quantity - As required for the amount of data to be contained.
- C. Flysheets - Separate each portion of the manual with colored, neatly prepared flysheets briefly describing contents of the ensuing portion.
- D. Cover - Clearly identify the manual on the cover with at least the following information:
 1. OPERATION AND MAINTENANCE INSTRUCTIONS
 2. Chicago O'Hare International Airport
 3. City of Chicago
 4. (Complete Project name and Project number)

PART 9 PRODUCTS

9.01 MATERIALS AND EQUIPMENT:

- A. Materials and equipment must be new and must be labeled in accordance with CEC Section 14-64-010 and must bear the manufacturer's name, model number and other identification markings.
- B. Materials and equipment must be the standard product as may be modified by these Specifications, of a specified manufacturer regularly engaged in the production of the required type of material or equipment for at least five (5) years (unless specifically exempted by the Engineer, CDA, and FAA) and must be the manufacturer's latest design with published properties.
- C. Equipment and materials of the same general type must be of the same manufacturer throughout the Project to provide uniform appearance, operation and maintenance.
- D. Equipment and materials must be without blemish or defect and must not be used for temporary light or power purposes, including lamps, without the Engineer, CDA, and FAA's written authorization.
- E. Equipment and materials must comply with the requirements of the Contract Documents.

PART 10 EXECUTION

10.01 INSTALLATION OF WORK:

- A. The Contractor must perform all work with trained mechanics of the particular trade involved in a neat and workmanlike manner as accepted by the Engineer, CDA, and FAA.
- B. With the acceptance of the Engineer, CDA, and FAA and without additional cost to the contract, the Contractor must make minor modifications in the Work as required by structural interferences, by interferences with work of other trades and for proper execution of the Work.
- C. Work installed before coordinating with other trades so as to cause interferences with the Work of such other trades will be changed as directed by the Engineer, CDA, and FAA to correct such condition without additional cost.
- D. The equipment must be installed with ample space allowed for removal, repair or changes to equipment. Ready accessibility to removable parts of equipment and to wiring must be provided without moving other equipment which is to be installed or which is in place.
- E. The Contractor must compare the Drawings and Specifications, checking all measurements to determine the intent of the Contract Documents. Any discrepancies will be brought to the Engineer, CDA, and FAA's attention for interpretation.
- F. Locations of electrical outlets, lighting panels, cabinets, equipment, etc. are approximate and exact locations must be determined by the Contractor at the Project site.
- G. The Contractor must refer to Contract Documents for details, reflected ceiling plans, and large scale Drawings.

10.02 EQUIPMENT NOISE LIMITATION:

- A. Noise levels of electrical devices and equipment must be within acceptable limits as established by NEMA or other valid noise rating agencies. Engineer, CDA, and FAA's acceptance will be based on practical and reasonable considerations of occupancy requirements.
- B. The Contractor must check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration and chatter under normal conditions of use.
- C. When located other than in high-noise-level equipment rooms, the enclosures or solenoid-operated switching devices and other noise-producing devices must have anti-vibration mountings and non-combustible sound-absorbing linings.
- D. Transformers, reactors, dimmers, lamp ballasts, and solenoids must be designed and rated for "quiet" operation.
- E. The Contractor must remove and replace any individual electrical item or

device that is found to produce a sound energy output exceeding that of other identical devices installed on this Project or the requirements of the Contract Documents.

10.03 TRANSMISSION OF VIBRATION:

- A. Electrical equipment, conduit, and fittings must not be mounted to or supported by elements subject to vibration except by methods which must prevent transmission thereof.
- B. Where flexible conduit lengths are utilized as a means of isolating equipment and conduit systems vibration, care must be exercised to assure continuity of ground throughout.

10.04 PROTECTION:

- A. The Contractor must protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps. The use of such materials as tape, plastic bags, paper, rags, etc. is expressly forbidden. For conduits with threaded ends, as required by the Specifications, the Contractor must provide threaded caps for the protection of the conduit end.
- B. The Contractor must cover fixtures, materials, equipment and devices furnished or installed under this Contract or otherwise protect against damage, before, during, and after installation.
- C. Fixtures, materials, equipment, or devices damaged prior to final acceptance of the Work must be restored to their original condition or replaced at no additional cost.
- D. Equipment must be inherently safe and moving parts must be covered with guards.

10.05 NEMA RATINGS:

- A. NEMA 1 - materials and construction is limited to interior walls, finished rooms, electrical rooms, unless otherwise noted, and ceiling spaces except where the ceiling space is used as an air plenum.
- B. NEMA 12 - materials and construction must be employed in areas where air supply and/or return systems are located, i.e. fan rooms. NEMA 12 must also be used in enclosed garages above Code required limits, in areas such as baggage handling, mechanical rooms not wet rated, or as identified on the Drawings.
- C. NEMA 4X - materials and construction must be employed in all exterior areas, wet areas and in interior areas where wash down may occur, or as noted on the Drawings. When called for this material must be made of Grade 316 Stainless Steel.
- D. NEMA 7 & 9 - materials and construction must be employed in those areas so defined by either the Chicago Electrical Code or the National Electrical Code.

PART 11 METHOD OF MEASUREMENT

11.01 MEASUREMENT

- A. All work associated with this specification will not be measured separately for payment, but will be considered included in the overall Contract.

PART 12 BASIS OF PAYMENT

12.01 PAYMENT

- A. All costs associated with this section will not be paid for separately but are included in the overall Contract price. No additional time or monies will be granted to the Contractor for compliance with the requirements of this Section.

BASIC MATERIALS AND METHODS FOR FAA RELOCATIONS (SECTION 16100)

PART 13 GENERAL

13.01 SECTION INCLUDES:

- A. Work under this Section is subject to the requirements of the Contract Documents.
- B. Furnish and install all electrical work, materials and accessories indicated schematically by Drawings, schedules and as specified herein including, but not limited to, the following:
 - 1. Rigid Galvanized Steel Conduit (RGSC)
 - 2. RGS conduit with PVC coating
 - 3. Electrical Metallic Tubing (EMT)
 - 4. Flexible Metal Conduit (FMC)
 - 5. Intermediate Metal Conduit (IMC)
 - 6. Liquid-tight Flexible Metal Conduit (LTFC)
 - 7. Underground PVC Conduit
 - 8. Bushings
 - 9. Fittings
 - 10. Boxes
 - 11. Wire and Cable

13.02 RELATED WORK:

- A. As specified in the following special provisions:
 - 1. Structural Portland Cement Concrete for FAA Relocations (Section P-610).

13.03 REFERENCES:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.03.

13.04 SUBMITTALS:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.04.
- B. The Contractor must submit with the wire submittal a listing of the code numbers used by the Manufacturer of the wire/cable the Contractor is submitting.

13.05 QUALITY CONTROL:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.05.

13.06 DELIVERY STORAGE AND HANDLING:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.06.

13.07 WARRANTIES AND GUARANTEES:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.07.

13.08 EXTRA MATERIALS AND SPARE PARTS:

- A. None required

13.09 ENVIRONMENTAL REQUIREMENTS:

- A. None required

13.10 SPECIAL REQUIREMENTS:

- A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.
- B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.

PART 14 PRODUCTS

14.01 EQUIPMENT BASES:

- A. The Contractor must provide concrete pedestals, bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, hangers, channels, cradles, saddles, etc., for installation of all electrical equipment and apparatus that is floor mounted.
- B. Concrete pads must be 6 inches high, unless shown otherwise on the Drawings, complete with steel reinforcing and necessary bolts, anchors, etc. Where the concrete pad is set directly on a concrete floor, drill and epoxy dowels into the floor after scarification. These pads must be extended at least 2 inches beyond the equipment outlined on all four (4) sides, unless otherwise indicated on the Drawings. The Contractor must chamfer the edges of the pad at a 45° angle.

14.02 VIBRATION ISOLATION:

- A. Vibration producing equipment must have either spring elements in the hanger rods or isolation pads under the equipment.
- B. Conduit connections to vibration producing equipment must be made with flexible conduit, using either FMC or LTFC as required.
- C. Acceptable manufacturers must be Barry Division of Barry Wright Corp., Consolidated Kinetics Corp. or Mason Industries.

14.03 CONDUIT AND FITTINGS:

- A. Rigid Galvanized Steel Conduit (RGSC):
 - 1. Conduit and fittings must be rigid galvanized steel, heavy wall type, hot-dipped galvanized with zinc-coated threads and acceptable agency labeled.
 - 2. Rigid Galvanized Steel conduit and couplings must be threaded, rigid steel, hot-dipped galvanized after fabrication and must be in accordance with UL 6, Federal Specification WW-C-581d and ANSI Standard C80.1.
 - 3. RGSC must be used for all exposed work, unless permitted otherwise in these Specifications, outdoor conduit runs and for all conduit work installed in slabs.
 - 4. Split, compression or setscrew couplings and connectors are not acceptable. All connections and fittings must be threaded.
- B. Intermediate Metal Conduit (IMC)- Minimum size 2 inches:
 - 1. Conduit and fittings for intermediate metal conduit (IMC) must be heavy wall type, hot-dipped galvanized with zinc-coated threads and acceptable agency labeled.
 - 2. IMC and couplings must be threaded, rigid steel, hot-dipped galvanized after fabrication and must be in accordance with UL 6.

3. IMC can be used for indoor exposed work in dry locations. It must not be installed below 8 feet with the exception of completing conduit runs to cabinets, panels and pull and junction boxes where the installation has been in IMC.
 4. The use of "Uni-swivel" type IMC is acceptable. The "Uni-swivel" system must employ a fully threaded connection. The use of set-screw type connections is not acceptable.
 5. Splice, compression or setscrew couplings and connectors are not acceptable. All connections and fittings must be threaded.
- C. EMT Conduit
1. Electrical metallic tubing (EMT) "thin wall" conduit must be steel, electroplate galvanized after fabrication and acceptable agency labeled. The conduit must be in accordance with UL 6.
 2. EMT couplings and connections must be of the compression type with insulated throats. The insulated throats must be of flameproof and non-combustible composition materials.
 3. EMT must be used for indoor installations where the conduit is concealed in walls and above finished ceilings. EMT will not be installed in concrete.
 4. Set-screw, die cast, white or pot metal and indenter type fittings are not acceptable.
- D. PVC Coated RGS Conduit
1. PVC coated rigid steel conduit, including elbows and fittings must be made with RGS conduit, conforming to the RGSC Section if this Specification, to which is bonded a Polyvinyl chloride (PVC) coating for the protection of the conduit.
 2. The minimum thickness of the exterior coating must be 40 mils.
 3. A Urethane chemical coating must be uniformly and consistently applied to the interior of the conduit and fittings. The internal coating must be applied at a minimum thickness of 2 mils.
 4. The PVC coated galvanized rigid conduit must be U.L. listed / labeled. The Manufacturer must submit certified test results from a recognized independent testing company validating that their product meets or exceeds the requirements of ASTM D870-02 Testing Water Resistance of PVC Coating Using Water Immersion and ASTM D2247-02 Testing Water Resistance of PVC Coating in 100% Relative Humidity, to signify compliance to the adhesion performance standards.
 5. PVC coated conduit must conform to NEMA Standard RN1-1986.

6. All fittings and components for use with PVC coated conduits must be PVC coated as specified in this Specification. Each coupling must be furnished loose with each length of the conduit and must have a PVC sleeve extending one (1) pipe diameter, or 2 inches, whichever is greater, beyond the end of the coupling. The inside diameter of the sleeve must be the same as the outside diameter of the IPS conduit used with it. The wall thickness of the sleeve must be the same as the PVC coating in the conduit. All screws for fittings which are PVC Coated must be Stainless Steel.
7. PVC coated conduit must be used in chemical environments, and for exterior work and underground ductbanks where so specified.
- E. Any portion of the conduit system that shows corrosion within the guarantee/warranty period must be replaced at no cost to the City.
- F. The minimum conduit size, unless specified otherwise, is 3/4 inch.
- G. All conduit fittings must be of the types specified, must be in accordance with UL 514 for normal application, and UL 886 for hazardous applications
- H. Acceptable conduit manufacturers must be Allied Tube and Conduit Corp., Wheatland Tube Company or Steel Duct Conduit Products.
- I. Acceptable conduit fitting manufacturers must be Appleton, Crouse-Hinds, OZ Gedney, Bridgeport, Regal or T&B.

14.04 FLEXIBLE CONDUIT AND FITTINGS:

- A. Liquid-Tite Flexible Conduit (LTFC) must be galvanized steel with a moisture and oil-proof plastic-coated jacket, listed and labeled by an acceptable agency. LTFC must be rated for the temperature environment in which it must be placed.
- B. LTFC must be in accordance with UL 360, with PVC outer jacket and integral ground conductor.
- C. Connectors must be malleable iron or steel with insulated throat, squeeze-type, with annular gripping rib. Particular attention must be given to maintaining ground bond and firm support through flexible connections. Liquid-tight connections must have insulated throats.
- D. Flexible metal conduit (FMC) must be in accordance with UL 1.
- E. Fittings for FMC must be specifically designed and manufactured for the use with FMC.
- F. Flexible metal conduit installed in air return ceilings and other plenums will be as approved by the City of Chicago Bureau of Electrical Inspection.
- G. Acceptable manufactures are Anamet, Electro-Flex or Ultra-Tite.

14.05 PVC CONDUIT:

- A. Non-metallic conduit must be PVC Schedule 40 with concrete encasement where shown on Drawings.
- B. PVC conduit, including elbows and couplings, must meet the requirements of NEMA Standard TC2 (latest edition), UL Standard 641, Federal Specifications WC-1094A and must be UL rated and listed for use with 90 degrees C rated conductors in compliance with Article 347 of the NEC. Materials must have a minimum strength of 7,000 psi, flexural strength of 11,000 psi, and compressive strength of 8,600 psi, all at an ambient temperature of 23 degrees C.
- C. The conduit must be manufactured from virgin PVC compound that must meet the applicable requirements of ASTM D1784.
- D. PVC conduit fittings must meet with the requirements of NEMA Standard TC3 (latest edition), UL Standard 514 supplement and Federal Specification WC-1094A.
- E. Standard fittings and cement must be obtained from the conduit manufacturer. Assembly of the PVC conduit system must be in strict accordance with the manufacturers instructions.
- F. Acceptable PVC conduit manufacturers must be National Pipe, Carlon (Lamson and Sessions), Cantex, and IPEX.

14.06 BUSHINGS:

- A. Bushings for Rigid and IMC conduit must be malleable iron body with 105 degrees C and with 150 degrees C insulating ring. Insulator material must be molded in place and must be non-removable.
- B. Acceptable manufacturers must be Appleton, Catalog Series BU75I, OZ/Gedney Catalog Series IBC-125.
- C. Grounding bushings for RGSC and IMC must be Appleton Series GIB-75L or OZ/Gedney Series HBLG0722. Bushings must be hot-dipped galvanized or triple coated with an insulating ring molded into the bushing with a 150 degree C rating. Insulating ring must be non-removable.
- D. All bushings must be of the threaded type. Set screw or compression type bushings are not acceptable.

14.07 CONDUIT SEALS AND EXPLOSION-PROOF FITTINGS:

- A. Conduit seals must be Crouse-Hinds Type EYS or EZS, Appleton ESUF or ESUM or OZ Gedney and filled with compound after first damming with proper fiber per the manufacturers instructions. The fiber and compound must be from the same manufacturer as the fitting.
- B. Explosion-proof seal, drain and breather conduit fittings must be installed as required by Code.

- C. Fittings and sealing compound must be designed for application at the Class, Division and Group at locations indicated on the Drawings. Fittings must be of the malleable iron type.
- D. Combination seal and drain fittings may be used in lieu of two separate fittings.
- E. Acceptable explosion-proof manufacturers must be Appleton Electric Co., Crouse-Hinds Co. or OZ Gedney.

14.08 PULL AND JUNCTION BOXES:

- A. Pull and junction boxes in non-hazardous environment exterior of buildings, interior wet areas, and chemical environment where chemicals are stored or mixed with liquids and areas where subject to corrosive elements must be NEMA Type 4X, 316 stainless steel, with stainless steel hinged cover, stainless steel fasteners and stainless steel hardware. Minimum gauge must be 12 ga. for boxes with no dimension larger than 18 inches, and 10 ga. for all other boxes. The welds must be ground or polished to present a clean and neat finish.
- B. Pull and junction boxes in non-hazardous and dry environment must be NEMA Type 12 gasketed, 12-gauge, seam welded, galvanized, with a rust inhibitive primer, screwed type or hinged as required by job conditions. All screws must be stainless steel.
- C. Pull and junction boxes located in a hazardous environment must be explosion-proof type, rated for the environment into which they must be located.
- D. Covers for non-hazardous boxes must be secured with round or flat head machine screws. Where required screws must be of the tamper-proof type.
- E. Where required by building construction, special junction or pull boxes must be provided in sizes and shapes determined from field measurements as required to make a neat and workmanlike installation. Special size and/or shaped boxes must be sized in accordance with the Chicago Electrical Code.
- F. Where required, boxes with metal barriers or separators for grouping of dissimilar conductors for voltage or system must be provided in compliance with the City of Chicago Electrical Code.
- G. Where required by the Drawings or job site conditions special finishes must be provided. These may be hot-dipped galvanized, PVC coated, etc. The Contractor must take extreme precaution when working in these areas to insure that the proper finishes are provided.
- H. Acceptable manufacturers must be Appleton Electric, Crouse-Hinds, Hoffman, Keystone, A.W. Circle, Chicago Switchboard or IEC.

14.09 OUTLET BOXES:

- A. Outlet boxes for indoor, dry work must be of the galvanized, pressed steel, knockout type. Boxes must be suitable for the structural conditions with the size determined by the number of conduits entering, and the devices or fixtures attached as required by the manufacturer. All outlet boxes must be in accordance with UL 514 for normal application and UL 886 for applications in hazardous locations.
- B. Outlet boxes must generally be 4 inches square or octagonal except as follows:
 - 1. In masonry walls, where conduit is installed concealed, each outlet box must be square cut masonry boxes.
 - 2. For concrete installation boxes must be suitable and constructed for installation in concrete.
 - 3. In exposed work, suitable boxes must be used for switches and receptacles. The NEMA type must be as described in this Specification.
 - 4. Outlet boxes for use outdoors or in wet/damp locations must be of the threaded hub, cast malleable iron type, with malleable iron cast covers. Covers must be gasketed unless of the threaded type.
 - 5. In finished plaster walls, drywall, etc., raised device covers on outlet boxes must be provided.
 - 6. Where 1-1/4-inch conduit is required, the box size must be a minimum of 4-11/16 inches square.
- C. Proper covers on flush mounted boxes must be provided.
- D. Device Boxes
 - 1. Recessed ceiling fixtures, unless otherwise specified by the light fixture manufacturer, must have 4 inch square sheet steel box with blank cover.
 - 2. Surface mounted ceiling fixture and surface mounted wall bracket fixtures must have 4 inch sheet steel octagon box with round opening plaster ring.
 - 3. Ceiling outlets and wall bracket outlets in dry locations must have 4 inch sheet steel octagon box with proper plaster ring.
 - 4. Outlet boxes on exposed conduit run in wet or damp locations must be a cast iron box with threaded hubs and gasketed cover.
 - 5. Wall switch and receptacle boxes installed in tiled or plastered walls must have 4 inch square sheet steel box or multigang box with proper tile or plaster ring as required. Two (2) gang utilization may be

provided by means of 4 inch square box with two (2) gang tile or plaster ring.

6. Wall switch and receptacle boxes in dry locations in brick walls, unfinished walls, woodwork, etc. must be a 4 inch square sheet box, with single gang or two (2) gang plate ring of the proper depth.
 7. The use of single gang boxes is prohibited.
 8. Extra deep boxes must be provided for such devices as dimmers, G.F.I.C.'s or where there are more than 4 wires spliced together with a wiring device(s) also contained in the same box.
- E. Plaster covers must have threaded ears and must be of suitable depth for the application.
- F. The Contractor must provide boxes with metal barriers, baffles or separators for grouping of dissimilar conductors or system separation.
- G. Acceptable manufacturers must be Appleton, Racco, Steel City or Crouse-Hinds.

14.10 EXPANSION JOINTS:

- A. The Contractor must provide expansion couplings with 8 inch movement and with bonding jumpers in all conduit crossing building and structure expansion joints.
- B. Expansion fittings must be Appleton, XJ with XJB jumpers, Crouse-Hinds or OZ Gedney.

14.11 FLOOR BOXES AND FITTINGS:

- A. Concrete tight floor boxes must be pressed steel boxes with adjustment brass flange and covers. Acceptable manufacturers must be Bell F4052, Hubbell 2529 or Walker.
- B. Watertight floor boxes must be cast iron with adjustable brass flange and covers. Close up plugs and reducing bushings must be provided as required. Acceptable manufacturers must be Bell F122-NR, Hubbell 2537 or Walker

14.12 WIRE AND CABLE - 600 VOLT:

- A. Wire and cable must be soft copper, properly refined and must have minimum conductivity of 98 percent. Aluminum conductors are not acceptable.
 1. Conductors for power and lighting must have 600-volt type insulation, must be not less than No. 12 AWG, must conform to the latest CEC and must bear acceptable agency label.
 2. Wire for signal and control systems must be No. 14 AWG stranded unless otherwise indicated on the Drawings, or elsewhere in the Specifications.

3. Factory wired equipment of a manufacturers' standard product line must be wired with the manufacturers' standard wire size and type provided that the wiring meets all applicable Code requirements. This does not apply to custom-built equipment as specified elsewhere in the Specifications.
- B. Wire and cable must be delivered to the job site in original packaging or on factory reels. All wire and cable must bear tagging or marking on the finish at regular intervals and consisting of manufacturers' name or code number, as well as the insulation type, voltage rating and acceptable agency listing.
- C. Wire and cable must be factory color-coded insulation and must be installed and connected as follows:
1. Color coding for voltage system of 250 volts and less must be
 - a. "A" Phase - Black
 - b. "B" Phase - Red
 - c. "C" Phase - Blue
 - d. Neutral- White
 - e. Ground - Green
 2. Color coding for voltage system of over 250 volts and less than 600 volts must be
 - a. "A" Phase - Brown
 - b. "B" Phase - Orange
 - c. "C" Phase - Yellow
 - d. Neutral- Gray
 - e. Ground - Green
 3. Green must be used for grounding only.
 4. Three-way and four-way switch travelers must be of a different color from colors stated above and they must be of the same color.
- D. The insulation must be applied tightly to the conductor and must be free stripping.
- E. Branch circuit wiring must be solid copper No. 12 AWG unless otherwise specified.
- F. Wire No. 10 AWG and larger must be stranded copper.
- G. Type THHN/THWN thermo-plastic insulated, 90 degrees C dry and 75 degrees C wet rated must be used for light, power and other wiring not specifically defined for all sizes. Type THHN thermo-plastic insulated 90 degrees C rated must be used for continuous row fluorescent fixture wiring.
- H. Type SF-2 silicone insulated glass braid jacket, 200 degrees C < 600-volt rated must be used for fixture wiring and or recessed incandescent fixture wiring and must be No. 12 AWG minimum.
- I. Teflon insulated 200 degrees C rated must be used for use within 5 feet of boilers and 1 foot of heating pipes.

- J. Wire and cables 600-volt rated for installation in floor slabs, etc. and outdoor use in exposed conduit must be XHHW-2. All underground ductbank installation must be RHH/RHW/USE, either XLP-USE or EPR with a CPE jacket, insulated.
 - K. If any of the cable types are modified by the Drawings, the Drawings must be followed.
 - L. Wire types for the telephone, communications, public address, computer data, door security and fire alarm systems must be in accordance with recommendations of the equipment manufacturer. Acceptable manufacturers of this type of cable must be American Insulated Wire, Belden, Dekoron, Okonite, Pirelli or West Penn.
 - M. The 600-volt insulated wires and cables must be factory tested prior to shipment in accordance with the latest ICEA standards for the insulation specified.
 - N. Samples and reports on the results of shop tests for all wire and cables, descriptive literature for splices and terminations must be submitted and must be treated as a Shop Drawing submittal.
 - O. Acceptable cable manufacturers for 600-volt rated cable must be American Insulated Wire Corp., Southwire, Cerro, Aetna,, Pirelli, and Draka Cableteq.
- 14.13 CONNECTORS:
- A. For connections to bus bars, use copper compression connectors. Connectors must be crimp type. All connectors must be copper. Copper compression connectors must be long barrel, tin plated, closed end compression type. The barrel for each cable lug must be sized for the exact cable size specified. Copper-Aluminum connectors are not acceptable.
 - B. Mechanical or set screw types are not acceptable. The cables must be terminated with the die type compression tools. The compression connection must be UL rated. Use only those tools which must provide a UL rated connection for the manufacturers product used.
 - C. Conductors No. 2 AWG and larger must terminate in two-hole solderless lugs.
 - D. Conductors No. 10 AWG and No. 4 AWG, inclusive, must terminate in one (1)-hole lug.
 - E. Multiple-hole lugs must have NEMA spacing
 - F. Acceptable connector manufacturers must be Burndy Type YA, Anderson Type VHCL, Thomas & Betts Co., Series 54800 and 54900 or Panduit Series LCB.

14.14 TAPE:

- A. Tape must be UL approved, black or colors as required, self-fusing jacketing tape, resistant to weather, oils, water and chemicals. Tape must meet or exceed Scotch 33+.
- B. Acceptable manufacturers must be Amazon, Plymouth or 3-M.

14.15 WIRE-PULLING LUBRICANT:

- A. Where necessary to use a lubricant for pulling wires, the compound must be listed by Underwriters Laboratories. Cable pulling lubricant must be biodegradable, non-flammable, non-toxic compound with a solid residue of not more than 1.5 percent and a viscosity of at least 50,000 C.P.S.
- B. Cleaning agents or lubricants that have a deleterious effect on conductors covering must not be used. Cable lubricant must contain no waxes, greases, silicones or polyalkylene glycol oils.
- C. Lubricant must be rated to match temperature conditions at the time of installation.
- D. Acceptable manufacturers must be Polywater J, High Performance Cable Lubricant, Ideal or Aqua-Jel 2.

14.16 SUPPORTS:

- A. Where conduits are supported with one-hole straps, spacers must be used to provide 1/4 inch minimum clearance between the conduits and supporting surfaces. All hangers, racks and straps must be galvanized steel.
- B. Perforated strap hangers are not acceptable. The use of tie wire is not acceptable.
- C. Hanger rods for trapeze-type hangers must be made from high tensile strength carbon steel not less than 3/8 inch diameter. The rods must have free-running, burr-free Unified National Coarse threads, with an electro-galvanized finish. Threaded rods used outdoors, in wet areas or in corrosive areas must be Grade 316 stainless steel.
- D. Conduit supports for trapeze hangers must be made from U-shaped steel components which are galvanized. Minimum material thickness must be 12 gauge. Supports must be hot-dipped galvanized or stainless steel for exterior use. For areas of corrosive nature, or where PVC Coated strut is used, PVC coated components must be provided. The use of painted components is prohibited. The miscellaneous components which are required to complete the support materials, except the threaded rod, must have the same finish as the U-shaped channel. Conduit supports must be as manufactured by Unistrut Corp., Kindorf, Powerstrut or B-line.
- E. When conditions exceed the structural capabilities of U-shaped strut the Contractor must submit for review detailed Drawings indicating the proposed

method of support. The submittal must contain complete details of fabrication, calculations, materials and finishes.

- F. All field cut ends must be treated in a manner which must insure the integrity of the support system immediately after cutting and before installation. The repair must be done with materials which are compatible with the factory finish. In no case must spray on galvanizing be acceptable for PVC or other special finishes.
- G. Supports must be held to concrete walls and ceilings by power-driven fasteners or electro-galvanized steel or stainless steel inserts as manufactured by Ramset, Unistrut Corp. or Hilti. The support type must be determined by the area conditions.
- H. Where single conduits are supported in ceilings, products such as "minis", must be used. The hanger rod size must be as required by the hanger manufacturer.
- I. In metal stud walls, products such as "Caddy clips" must be used to support conduits. These supports must be of the locking type which have an overstrap to lock the conduit into place. These supports must be held in place with screws which must attach them to the metal stud construction.
- J. For 4 inch and 4-11/16 inch boxes, 1/4 inch rods must be the minimum size. Larger size boxes must have hanger rods sized in accordance with the load, but must not be smaller than 1/4 inch.
- K. Boxes installed in stud walls must be secured to the studs by attaching to the stud with mounting brackets specifically designed for this purpose. No box will be installed with support supplied on only one side of the box. Acceptable manufacturers are Appleton, Raco, Steel City or Caddy.

14.17 SPLICES:

- A. No splicing will be permitted except in junction boxes, handholes and manholes. Splices and terminations in wire/cable larger than 8 AWG must be made with compression type connectors and lugs. The tools used must provide a UL certified connection. Indenter type compression fittings must not be acceptable. Lugs must be one (1) or two (2)-hole, color keyed. Lug bolting must include a flat washer, Belleville washer and a locknut.
- B. Outdoor splices of conductors must be made using heat shrink products which, when properly installed, must produce a completely sealed covering over the connectors or lugs. The tube or jacket must be completely coated with mastic to insure a 100 percent seal to the conductor jacket. The splice, when completed, must be watertight. An acceptable manufacturer of this type product is Raychem Inc.
- C. All splices and pigtail connections in lighting and receptacles wiring No. 8 AWG and smaller must be made up with the pre-insulated spring connectors. Acceptable products are Buchannan, Ideal Wingnut or Scotch Lock 2.

14.18 TERMINAL BOXES:

- A. Terminal boxes must be UL 508 Listed for Type 12 and Type 13 or Type 4X. They must conform to NEMA Standards for Types 12 and 13 or Type 4X and they must conform to JIC Standard EGP-1-1967.
- B. Each box must have provisions for the mounting of terminals, either on an internally mounted panel, or on metal strips which are provided by the manufacturer expressly for the purpose of attaching terminal strips. Wherever a panel or strips are provided they must be mounted on studs using lock washers and nuts.
- C. Terminal boxes in non-hazardous environments which are exterior of buildings, in interior wet areas, in chemical environment where chemicals are stored or mixed with liquids and in corrosive areas must be NEMA Type 4X, 10-gauge minimum for boxes with a dimension over 18 inches, 12 - gauge minimum for smaller boxes, 316 stainless steel with stainless steel hinged door, stainless steel fasteners and stainless steel hardware. Boxes must have provisions for external locks. The welds must be ground or polished to present a neat and clean appearance.
- D. Terminal boxes in non-hazardous and dry environment must be NEMA Type 12 gasketed, 12-gauge, seam welded, galvanized, with a rust inhibitive primer, hinged door, and must have provisions for external locking. The interior must be painted with white enamel. The exterior will be painted, color as required by the Engineer, CDA, and FAA.
- E. Acceptable manufacturers of enclosures are Hoffman, A. W. Circle and IEC.
- F. The terminals must be 30 ampere, 600 volt rated, barriered, with pressure plate lugs for termination of control wiring. The terminals must be of modular design and must be held in place in such a manner as to prevent them from becoming loose when adding or removing terminals. Terminal blocks will be acceptable agency listed. Acceptable manufacturers are Buchanan, Allen Bradley, Eaton/Cutler-Hammer/Westinghouse, G. E., and Square D.
- G. The terminal box assembly must be acceptable agency labeled. Identification of terminals and wiring must be per Specification 16195 - Identification.
- H. Acceptable suppliers of the assembled terminal box are Panatrol, Chicago Switchboard, and Gus Berthold.

PART 15 EXECUTION

15.01 INSTALLATION - GENERAL:

- A. Interferences:
 - 1. Locations of conduits, fixtures and equipment must be adjusted and supported to accommodate the work in accordance with field conditions encountered, anticipating potential interferences.

2. The Contractor must determine the exact route and location of each pipe, duct and electrical raceway prior to fabrication.

B. Accessibility

1. The work must be installed to permit removal (without damage to or removal of other parts) of parts requiring periodic replacement or maintenance and as defined by the Chicago Electrical Code.
2. Conduits and equipment must be arranged to permit ready access to components and to clear the openings of swinging and overhead doors and of access panels.
3. The Contractor must provide necessary access panels in equipment as required for inspection of interior and for proper maintenance. Access panels must be as specified in other parts of the Contract Documents.

C. Exterior Wall Openings

1. Openings in exterior walls, particularly at or below grade, must be kept properly plugged and caulked at all times, except when being worked on, to prevent the possibility of flooding due to storms or other causes.
2. After completion of work, openings must be permanently sealed and caulked so as to provide leakproof and/or to maintain the fire-rated conditions of the structure penetrated.

15.02 CONDUIT INSTALLATION:

- A. All conduits must be installed as required. The conduit system must be installed complete with all accessories, fittings, boxes and supports in an approved and workmanlike manner to provide proper raceways for electrical conductors.
 1. All conduit runs shown in the Drawings are shown diagrammatically for the purpose of outlining the general method of routing the conduits to avoid interferences.
 2. Conduit systems must be run concealed or exposed as shown or as dictated by job-site conditions.
 3. Exposed conduit runs must be installed true, plumb, parallel with or at right angles to adjacent building members, and must present an orderly, neat and workmanlike appearance.
 4. Field bends must be carefully made to prevent conduit damage or reduction in internal areas. All bends must be made with equipment specifically made for the purpose of bending conduit. The bending radius must not be less than six (6) times the nominal diameters of the conduit, with carefully matched bends on parallel runs to present a

neat appearance. The number of crossovers must be kept to a minimum. Where larger radii are required to meet utility company requirements, etc., they must be provided. Hickey bends are not acceptable.

5. For PVC conduit bends which exceed the radii available the Contractor must field bend the conduit using equipment and methods as directed by the conduit manufacturer. Extreme care must be taken not to deform the conduit.
6. Conduits which are crushed or deformed in any way will not be installed.
7. All conduits cut on the job must be carefully reamed inside and out to remove burrs. All field cut ends of conduits must be cut square and must be done with the proper tools. The use of tubing cutters is strictly prohibited. Conduits not properly cut will be replaced at no cost to the City.
8. For PVC coated conduits all field bends must be made using tools specifically designed for the purpose of bending PVC coated conduits. If the Contractor does not have these tools he must bend the PVC coated conduit using a bend radius one size larger than would normally be used for that size conduit.
9. All threads must be tapered. No running threads will be permitted. Threads on steel conduit must be given a coat of zinc duct in oil, or other approved compound. All joints must be properly tightened and must be watertight and insure a low resistance ground path in the conduit system.
10. For PVC coated conduits field cut threads must be done with tools as specified by the manufacturer of the PVC coated conduit. Extreme care must be taken to prevent damage to the PVC coating. The manufacturers' instructions must be followed for this operation. After the threads have been cut any damage to the coating must be immediately repaired using materials and methods as recommended by the manufacturer. The material thickness of any field repair must be equal to the factory finish which has been damaged. Repairs must be done immediately.
11. The Contractor must exercise extreme care in the assembly of PVC coated conduits. Metal jawed tools will not be used for this assembly. Conduits which are damaged as a result of using improper tools must be removed and replaced by the Contractor at no cost to the City.
12. All conduits must be carefully cleaned before and after installation and all inside surfaces must be free of imperfections likely to injure the cable. After installation of complete runs, all conduit must be snaked with an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal

diameter of the conduit. Any conduits through which the mandrel will not pass must be removed and replaced. All conduits installed in interior areas 1 inch and smaller must be cleaned by pulling clean rags thru the conduits. After cleaning, the ends of the conduits must be protected as specified to prevent the entrance of water and other foreign matter. The use of such items as plastic bags, tape, paper, rags, etc. will not be used under any circumstances. Failure to properly protect conduit ends must result in the Contractor having to again mandrel the conduits immediately before installing the wires.

13. Lines of nylon, polyolefin or polypropylene, propelled by carbon dioxide, vacuum or compressed air, must be used to snake or pull wire and cable into conduits. Flat steel tapes or "sparks" type tapes can only be used in conduit runs of 50 feet or less. They will not be used in PVC or PVC coated conduits. Metal cables are expressly forbidden for pulling wire/cable. Non-metallic pull tapes can be used for all types of conduits.
 14. Where conduits are connected to boxes or equipment enclosures, drilled holes or full size knockout openings must provide electrical continuity for grounding and must be assured by the use of bonding type locknuts. Where connections are at slightly eccentric openings, jumper type grounding bushings and wire jumpers must be installed. Should the openings become excessively eccentric, as determined by the Engineer, CDA, and FAA, the box or equipment must be replaced at no cost to the City. The use of reducers will not be found acceptable under any circumstances.
 15. Telephone conduit radius must not be less than 10 conduit diameters. The Contractor must verify with the company providing phone service as to their actual requirements for installation.
 16. Conduit systems must be installed, with fittings, couplings, connectors, double locknuts, bushings, etc., and made up tight to insure ground continuity throughout the system.
- B. As far as practicable, conduit must be pitched slightly to drain to the outlet boxes, or otherwise installed to avoid trapping of condensate. Where necessary to secure drainage, a breather-drain fitting must be installed in the boxes at low points. Each breather drain fitting must be manufactured by Crouse-Hinds Co., Appleton Electric Co., or O.Z. Gedney. Conduit must not run through columns or beams unless so specifically detailed, submitted and accepted by the Engineer, CDA, and FAA.
- C. Each building expansion joint, each straight uninterrupted run of surface mounted conduit, and vertical risers in excess of 100 feet must be provided with appropriate expansion fitting. The distance between fittings as installed must not exceed 200 linear feet.

- D. The Contractor must furnish and install expansion couplings and bonding jumpers for metallic conduit system where conduits cross building expansion joints or where conduits transfer between structurally independent pipes, poles or supports.
- E. Conduits crossing building-expansion joints must be provided with expansion fittings and flexible grounding bonds bypassing the fittings to insure ground continuity.
- F. Conduit Installed in Concrete Slab
 - 1. Where conduit is to be installed in concrete slab, conduit must be placed in the center of slab and no closer than 3 diameters from adjacent conduits. The maximum outside diameter of conduits in the slab must be no greater than $\frac{1}{4}$ of the slab thickness. The minimum slab thickness must be 6 inches for embedded conduit installation. In no case must conduits be installed in the bedding material of the finish floor covering.
 - 2. Conduit openings must be temporarily plugged to exclude water, concrete, plaster and other foreign material. For smaller conduits push pennies may be acceptable, as determined by the Engineer, CDA, and FAA.
 - 3. Conduits run in or below any floor slab must be entirely encased in reinforced steel concrete. In no case must conduit be laid in the fill below slab.
 - 4. Conduits embedded in concrete must be blocked and braced in place by use of adequate conduit separators to prevent displacement during the placing of concrete. The Contractor must be held responsible for proper position of conduits and must rearrange any conduit that may be displaced, when concrete is placed, at his own expense.
 - 5. Conduits run in floor slabs or underground must be a minimum of 1 inch in size, rigid galvanized steel conduit unless noted otherwise on the Drawings.
 - 6. All concealed conduits must be placed in walls and ceilings at the proper time, in accordance with the progress of the structural work.
 - 7. Concrete-encased conduit runs extending through structural expansion joints must have fittings permitting longitudinal movement of the conduit ends without damaging the contained wires. The fittings must be watertight and include a grounding bond.
- G. Conduits installed in dry locations requiring a flexible connection for adjustment or vibration isolation must be provided with an 18 inch minimum length of either FMC or LTFC, as required by the area conditions.
- H. Flexible conduit installed in wet locations, exterior locations, air return ceilings and at motors must be liquid-tight type except for lighting in air return ceilings

which must be of a type acceptable to the Bureau of Electrical Inspection, City of Chicago.

- I. Flexible conduit in ½ inch trade size may be used for connections with a maximum length of 18 inches for such devices as limit switches, for which the use of ¾ inch flexible conduit may not be practical due to the manufacturer providing only threaded hubs of the ½ inch size. In the case of such installations as electric door locks, where only ½ inch provisions are available, the Contractor can install ½ inch conduit from the device to a box located as close as possible.
- J. The number of 90 degree bends must be limited to four or a total of 360 degrees including all off sets, sweeps, kicks, etc. This must be between any pull points.
- K. The Contractor must be aware that the conduits are sized for cables routed in exposed rigid steel conduits, as denoted on the Contract Drawings. The same cables may be partly routed in ductbanks. The ductbanks are sized on the Drawings.
- L. Conduits entering motor control center conduit compartments, switchboards, switchgear, unit substations, etc. must be fitted with jumper type insulated grounding bushings, bonded together and to the structure of the enclosure by a continuous bonding wire.
- M. Conduit runs entering the building from outdoors are subject to moisture accumulation due to condensation. After the wires and cables are installed, the end of the conduit continuing into the warmer area must be packed with a non-setting sealing compound.
- N. All communication, telephone, data and computer conduits must have a minimum separation of 12 inches from any AC power and control conduits.
- O. The Contractor must orient outlet boxes for duplex receptacles or multiple gang switches for horizontal mounting.
- P. An outlet box must be provided at each location requiring one
 1. Outlet box locations as shown on the Drawings must be considered as approximate only, unless noted otherwise on the Drawings.
 2. Exact locations must be determined from the Drawings and/or from field instructions and coordination with the work of all other trades.
 3. Boxes must be installed true and plumb, so that the covers or plates must be level, and at uniform elevations for the type of wiring devices contained.
 4. Boxes for toggle switches and pilot lights at doorways must be located at the strike side of the door.
 5. Fixtures which weigh more than 5 pounds must be supported independently of the box.

- Q. There must be no more openings made in any box than are required for the conduits entering same. Depths of boxes must be as to allow for easy wire pulling and proper installation of wiring devices.
- R. All boxes must be supported independent of the conduit system. The boxes must be supported from the building structure. Conduits must not be supported from the boxes.
- S. Switches and receptacles must be ganged in a common box only when directed or indicated on the Drawings.
- T. All ceiling outlets must have adequate supports and must be equipped with adequate devices to carry and mount the light fixtures. They must not be supported from the ceiling structure.
- U. Conduit connections to NEMA 12 equipment must be made up with sealing locknuts. Conduit connections to NEMA 4 and NEMA 4X equipment must be made with Myer's type hubs. In no case must the Contractor terminate conduit to a NEMA 4 or 4X component by providing knock-outs and locknuts.

15.03 CONDUIT CONNECTIONS TO EQUIPMENT:

- A. The conduit system must terminate at the terminal box or at the conduit connection points of electric motors, devices and equipment. Terminations of conduit at such locations will permit direct wire connections to the motors, electrical devices or other equipment.
- B. Conduit connections must be made with rigid conduit if the equipment is fixed and not subject to adjustment, mechanical movement or vibration. A union type fitting must be provided when GRS or IMC is terminated at each enclosure or piece of equipment which contains a threaded termination for the conduit. This may be a threaded hub or through a fitting such as a Myers type hub. Conduit terminations using double locknuts do not require union type fitting.

15.04 PULL BOX INSTALLATION:

- A. Pull boxes must be installed where shown and where necessary to insure that the installed cable will not be damaged.
- B. The Contractor must add pull boxes where needed even through not shown on the Drawings.
- C. Junction boxes and pull boxes of the proper size and shape must be provided. Where suitable, standard outlet boxes must be used as junction boxes and pull boxes.
- D. Pull boxes and junction boxes must be supported from the building structure and must not be supported by the conduit. Pull/junction box supports must comply with the applicable requirements for supports as contained in these Specifications.

15.05 HAZARDOUS AREAS:

- A. The conduit system installed in hazardous locations must be provided as shown, specified and required. The installation must conform to the requirements of the CEC for Class, Division and Group as shown on the Drawings or required by Project conditions.
- B. Explosion proof fittings must be provided for all conduits, within hazardous areas, leaving the hazardous areas, and where they enter the non-hazardous areas, as required.
- C. Explosion-proof seal, drain and breather conduit fittings must be installed as required by Code.

15.06 WIRING INSTALLATION:

- A. All cable and wire must be installed in conduit.
- B. No splices will be permitted between terminals, except at approved junction or terminal box points. Cable and wire runs must be looped through pull boxes without cutting and splicing where possible. Boxes must be sized to allow cable and wire installation without splices.
- C. All hardware, such as cable stanchions, racks, insulators, brackets, structural supports, wall inserts, cable and junction boxes, bolts, connectors, clamps, fittings and other accessories for the installation of wires and cables in buildings, manholes and outdoors must be furnished and installed complete to provide a satisfactory operating installation.
- D. All wiring systems must be "pullable" and use of "BX" is prohibited.
- E. Branch Wiring
 - 1. Branch circuit wiring for lighting and other single phase applications must be sized for a voltage drop in accordance with the City of Chicago Electrical Code.
 - 2. The maximum voltage drop for each circuit must be 3 percent for power and 1 percent for lighting circuits.
 - 3. The Contractor must use multi-wire circuits utilizing separate neutrals and must follow the color coding established. The Contractor must size the wire in accordance with the following:
 - a. Under no circumstances must any switch break a neutral conductor.
 - b. Where farthest wiring device or light is no more than 75 feet from the panel, No. 12 AWG wire must be used between all wiring devices and for home runs.
 - c. Where the farthest wiring device or light is more than 75 feet from the panel, the Contractor will submit voltage drop calculation to the Engineer, CDA, and FAA, prior to sizing the

wire. These calculations must show the wire size to be installed by the Contractor.

- d. The minimum wire size must be No. 10 AWG between the panel and the first wiring device or fixture when located more than 75 feet from the panel, with a minimum No. 12 AWG wire being used between all other wiring devices or fixtures.
 - e. In office areas, each circuit must have its own neutral. Networking of circuits is not permissible in these areas. This does not apply to lighting circuits with the exception of fixtures which employ electronic ballasts.
- F. Wiring systems in plenum spaces must be installed in accordance with the Chicago Electrical Code and the Chicago Fire Code.
- G. Feeders must be installed with the sizes as indicated on the Drawings and must be connected as required for the proper operation of the equipment they serve.
- H. Building utility motors must be provided under other sections of the Specifications.
- 1. The Contractor must make all connections necessary to leave motor driven equipment in satisfactory operating condition.
 - 2. The Contractor must provide power branch circuit wiring for all motors and starting equipment.
 - 3. The Contractor must verify the actual motor sizes to be installed, and the actual locations, and provide wiring and equipment of proper sizes as required.
 - 4. At the time when each motor is first operated, the Contractor must check the motor terminal voltages and the amperes in each motor lead to ascertain that, under normal load conditions, the currents do not exceed the nameplate rating on the motor.
 - 5. If the ampere reading in any leads exceeds the nameplate rating of the motor, or if the motor terminal voltages vary more than 5 percent from the nameplate rating of the motor, the Contractor must disconnect the motor and request further instructions from the Engineer, CDA, and FAA.
- I. Proper termination of conduits and wires at motors, control panels or other equipment items must be provided.
- J. In the event that conduit and wire sizes increase beyond the motor or equipment manufacturer's normal provisions for conduit and wire terminations, due to voltage-drop or other considerations in motor branch-circuit designs, the Contractor must provide auxiliary termination facilities, with adequate boxes, lugs, terminals, knock-outs, etc., as may be required.

- K. Equipment having safety devices such as limit switches, overload relays, high-low water cut-outs, high-low pressure switches, solenoids, pilot devices, flow switches, freeze protection thermostats, etc., must be so wired that they must always be in the control circuits of selector switches regardless of switch position.
- L. The only devices that may be shunted out in the manual position of a selector switch are remote pushbutton stations, clocks, timers and room thermostats and ductstats of the non-limit type.

15.07 SPLICES AND TERMINATIONS - 600-VOLT CABLE:

- A. All splices and terminations must be carefully taped and covered using material recommended by the cable manufacturers, to provide insulation equal to that of the conductors.
- B. All splices must be made in proper splice or junction boxes. Splices must not be made in power or control panels. Splices must not be pulled into any conduit. Splices must not be made in any fitting.
- C. Shielded Cable Grounding
 - 1. Shielded control cables must have the shields grounded at one (1) end. The shield must be insulated from ground, equal to that of the original cable instructions, at each splice.
 - 2. Coaxial cable shields must be insulated from ground throughout the length of the cable run. The shields must be grounded at, and only at, the coaxial connector terminating in the equipment on each end of the cable run.
- D. Splices
 - 1. Splices must be performed only by experienced and qualified cable splicers regularly engaged in this type of work.
 - 2. Shielded cables must have the ends of the shielding bonded together across splices to provide a continuous electrical path. Splice will be made with a terminal block and only when approved by the Engineer, CDA, and FAA.
 - 3. All cable runs must be given an insulation resistance test and continuity check at the completion of each splice throughout the length of the cable run.
 - 4. Where a cable is cut preparatory to splicing, the work must proceed without delay. When an unavoidable delay is encountered in completing a splice, the opened cable must be protected to prevent the entrance of moisture and foreign matter with a heat shrink cap.
 - 5. The Contractor must splice control cables with the splice kits and materials manufactured for the purpose of splicing control wiring and in accordance with manufacturer's instructions. A power cable splice

kit or resin must not be used to make a control cable splice, and vice versa, under any conditions.

15.08 WIRING METHODS:

- A. All remote mounted devices such as control stations limit switches or pressure switches in a common circuit must have their wires brought back to the terminals on one (1) panel.
- B. When multi-conductor cables are used the number of conductors to be provided in each cable to be such that at least 1 spare conductor must be available for up to 5 conductors in use, 2 spare conductors must be available for 6 to 10 conductors in use, and 20 percent must be available for more than 10 conductors in use. The spare conductors are only required between major electrical equipment.
- C. Multi-conductor cable jacket must be pulled back and neatly trimmed to allow conductors to be separated, so they can be terminated to more than one (1) device. The cable must be supported in the panel where it enters the enclosure.
- D. Spare conductors must have the ends taped and they must be neatly coiled and tied and left in the bottom of the enclosure. They must be marked as spare conductors.

15.09 ELECTRICAL HARDWARE INSTALLATION:

- A. Locations
 - 1. Anchor bolts, sleeves, inserts, hangers and supports required for the work must be furnished and installed by the Contractor.
 - 2. Any expense resulting from improper location or installation must be paid for by the Contractor at no cost to the Engineer, CDA, and FAA.
 - 3. Where conduit and equipment is to be suspended from poured concrete construction, the Contractor must provide approved concrete inserts in the form work. Expansion shells may be used on precast concrete members but not closer than three (3) inches from the edge. The Contractor must verify the acceptable depth of anchors before beginning work on any pre or post tensioned members.
- B. Hangers
 - 1. The Contractor must provide adequate supports for all conduits and equipment, either suspended from the construction above, or by means of struts to the construction below. Where metal deck pan is used for the concrete floor above, anchors must only be placed in the rib. When the weight of the support system, including the completed electrical assembly, exceeds 100 pounds per hanger the Contractor will submit his design for review to the Engineer, CDA, and FAA.

2. Hangers for support of conduit must be fabricated type, but not of the perforated iron type, and must conform to the requirements of the Contract Documents.
3. Hangers must be suitable for the weight of the material / equipment being supported. This must include any and all pulling loads, as well as the load of the conductors, which the support may be subject to.
4. Trapeze type hangers may be used where several conduits are to be installed at the same elevation.
5. The Contractor must provide straps, clamps, threaded rods, turnbuckles and anchors and all miscellaneous specialties for the attachment of hangers and supports to the structure.
6. Vertical conduits must be supported by heavy metal clamps or collars anchored in or to the construction at each floor.

C. Conduit Supports

1. Exposed conduits must be supported in an approved manner. Conduits must not be fastened to or come in contact with any mechanical system pipes, ducts or equipment of other trades, except as approved by the Engineer, CDA, and FAA. In all conduit work, acceptable hangers, racks or a combination thereof must be used as supports.
2. Conduit trapeze supports must be located at intervals not exceeding 5 feet. Single conduits must be supported as required by the Chicago Electrical Code.
3. Conduits must be securely fastened to each trapeze with U-bolts, straps or clamps.
4. Whenever possible conduits must be supported from the building structural steel. Beam clamps must be used to attach to the steel. When the conduit supports must be attached to the structural concrete proper anchors must be installed. Anchors must not be closer than 3 inches from the edge of the concrete. The use of anchors containing lead, plastic or wood is strictly prohibited.

D. Sleeves

1. The Contractor must provide sleeves in fire rated walls and floors, and when penetrating CMU walls.
2. Wall sleeves must be minimum 18-gauge galvanized sheet metal, as approved by Code, of sufficient length to finish flush with finished surfaces at both ends of the sleeves.
3. Sleeves must be not less than 1 inch larger than outside diameter of the conduit.

4. Floor sleeves must be galvanized steel pipe, as approved by Code, 3 inches above floor, and must be watertight.
5. Where conduit passes through floors or exterior walls, the Contractor must caulk sleeves with an appropriate system to insure the complete sealing of the opening to prevent passage of water, dirt or air and to insure the fire rating of the structure penetrated.
6. Sleeves must be set true to line plumb and position and must be so maintained during construction. Where sleeves are provided in poured concrete, the Contractor must inspect same during and after concrete is poured to insure proper position and to correct any deviation at the Contractors expense.

15.10 PAINTING:

A. Prime Coat

1. Shop fabricated and factory built equipment without a primer must be galvanized or protected by plating. Before delivery to the site, the equipment must be cleaned and given one (1) shop coat of zinc-chromate primer.
2. Any portions of the shop coat damaged in delivery or during construction must be recoated.
3. Nameplates, labels, tags, stainless steel or chromium-plated items such as motor shafts, levers, handles, trim strips, etc. must not be painted.

B. Finish Coat

1. Conduit and equipment must be left cleaned and primed, ready for finish painting provided under the Painting Section of the Specifications.
2. All equipment, panelboards, switchboards, etc. must be factory finished in baked enamel or lacquer, or as specified. Standard finishes must be as approved. All scratches must be neatly touched-up by the Contractor.
3. All metal work installed by this Contractor exposed to weather and not factory finished must be painted with one coat of rust inhibitive primer and two coats of oil based paint of color selected by the Engineer, CDA, and FAA.

15.11 PATCHING:

A. The Contractor must provide all cutting and patching of building materials required for the installation of the work herein specified:

1. No structural members must be cut without the approval of the Engineer, CDA, and FAA.

2. Roof deck is considered a structural member.
 3. Approved cutting must be done with concrete saws or core drills.
- B. Patching must be provided by mechanics of the particular trade involved and done in a neat and workmanlike manner.
- C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs must be cut by the Contractor. The Contractor must see that they are properly located.
- D. Slots, chases, openings and recesses in the structure must be cut by a qualified Contractor. The Contractor must patch and repair as required. Where patching or repair becomes excessive at a location, as determined by the Engineer, CDA, and FAA, the Contractor must use skilled craftsmen of the appropriate trade to make the repairs or patching.

15.12 CLEANING:

- A. Open ends of conduit and equipment must be properly capped or plugged to keep dirt and other foreign matter from entering.
- B. Each length of conduit must remain capped until the conduit connections are required.
- C. Trenches must be kept free from water. Conduits for ductbanks must not be laid when conditions of the trench are unsuitable for such work, or the weather must prevent quality work.
- D. When work is not in progress, open ends of conduit and fittings must be securely closed so that no water, earth or other substance must enter.
- E. When so directed by the Engineer, CDA, and FAA all material being removed must become the property of the Contractor, must be removed from the Airport and must be legally disposed of off City property by the Contractor.
- F. The Contractor must be responsible to keep the areas where work is occurring broom clean at all times.

PART 16 METHOD OF MEASUREMENT

16.01 MEASUREMENT

- A. All work associated with the requirements of this specification will not be measured separately for payment, but will be considered included in the overall Contract.

PART 17 BASIS OF PAYMENT

17.01 PAYMENT

- A. All costs associated with the requirements of this specification will not be paid for separately but are included in the overall Contract price. No additional time or monies will be granted to the Contractor for compliance with the requirements of this Section.

FIBER OPTIC CABLE AND EQUIPMENT FOR FAA RELOCATIONS (SECTION 16125)

PART 18 DESCRIPTION

18.01 GENERAL

- A. Work under this section is subject to the requirements of the Contract Documents and is to be used exclusively for FAA fiber optic cable applications.
- B. The Contractor must furnish and install all wall or rack mounted fiber optic cable, patch panels and ST type connectors as shown on the Contract documents for the Federal Aviation Administration (FAA), Fiber Optic Transmission System (FOTS) loop. Where space permits, all wall mounted fiber optic patch panels must be installed in enclosures.
- C. Furnish and install fiber optic cable suitable for outside or inside buildings, risers, ducts, plenum and air handling spaces and cable accessories required of the type and size shown on the drawings and specified herein for the FOTS loop, including but not limited to, the following:
 - 1. Multi-mode fiber optic cable for indoor/outdoor applications must be type-B, 12 strand, all-dielectric loose tube with water swellable aramid yarn to make it water resistant. Acceptable manufacturers are Corning Cable Systems, Alcoa, Belden, and Draka Cableteq.
 - 2. Patch panels and NEMA 1 and NEMA 4 enclosures and splicing kits, terminal connectors and accessories for termination in FAA facilities for a complete installation

18.02 REFERENCES

- A. Special Provision Basic Electrical Requirements for FAA Relocations (Section 16010).
- B. FAA Specification FAA-E-2761c, November 19, 1998, Cable, Fiber Optic, Multi-mode and Single-mode, Multi-fiber, with exceptions documented in this specification.
- C. FAA Order 1830.7, Fiber Optic Transmission Systems and Equipment Policy.
- D. FAA-STD-061, 10/15/2003. Fiber Optics Standard for Telecommunications Systems and Equipment, with exceptions documented in this specification.
- E. ANSI / TIA / EIA-STD-RS-455, standard test procedures for fiber optic fibers, cables, transducers, connecting and terminating devices.
- F. ANSI/TIA/EIA-STD-RS-359, standard colors for color identification and coding.

- G. ANSI/TIA/EIA-598A, fiber optic cable color coding.
- H. MIL-STD-202, test methods for electronic and electrical component parts.
- I. MIL-HDBK-454, standard general requirements for electronic equipment.
- J. MIL-STD-810, environmental test methods and engineering guidelines.
- K. NFPA 262, test for flame-travel and smoke of wire and cables used in air-handling spaces.
- L. Underwriters Laboratories, Inc. (UL):
 - 1. U.L. 910: Flame Retardancy.
 - 2. U.L. 1581 VW-1: Vertical Tray Cable Flame Test.
 - 3. U.L. 1666: Riser Cable.
- M. American National Standards Institute (ANSI)
 - 1. ANSI/TIA-568, 569 and 607.
 - 2. ANSI/TSB-36, 40 and 50.
 - 3. ANSI X3 T9.5.
- N. NETA: The International Testing Association Acceptance Testing Specification.
- O. Specification Section L-118 *CED/FAA Communication MH/HH As-Built Checklist*

18.03 CONTRACTOR QUALIFICATIONS

- A. The fiber optic cable installation must be installed and supervised by trained and experienced personnel. The cable terminations must be made by qualified technicians. Upon request by the Engineer, CDA, and FAA, the Contractor must provide documentation on qualifications and experience for fiber optic equipment installations. The Engineer, CDA, and FAA will determine if the Contractor is qualified to perform the Work.

18.04 QUALITY CONTROL

- A. The contractor is responsible for protecting all equipment and systems against harmful exposure to, or accumulations of dust, moisture, flooding, corrosion or other forms of damage and must clean and restore damaged finishes.

18.05 SUBMITTALS AND DELIVERABLES

- A. The following deliverables will be required from the Contractor as requirements for the formal acceptance of the fiber optic cable by CDA/FAA and subsequent Contractor Acceptance Inspection of fiber optic cable installation:

1. O & M Manuals/Product data and catalogs
 2. Fiber Optic Test Reports (Electronic form and included in 3-ring binders)
 3. Manhole/Handholes As-built Checklists or Reports (Section L-118)
 4. FAA Form 4650-12 *Material Requisition/Issue/Receipt*
 5. Fiber Optic Cable As-builts/Red-Lined Drawings
 6. Approved Submittals
 7. Warranties/Guaranties
- B. All of the above deliverables must be submitted in electronic form in addition to being compiled in five (5) sets of 3-ring binders for submittal to the Engineer, who will forward them to the FAA.

PART 19 EQUIPMENT AND MATERIALS

19.01 GENERAL

- A. The fiber optic cable must be according to FAA-STD-061, the ANSI, Electronics Industries Association (EIA).
- B. Multi-mode fiber. The fiber must be suitable for FAA applications, provide fiber cables of loose tube construction, with water swellable aramid yarn water blocking for indoor/outdoor applications, comprised of 62.5 μm multi-mode fibers.
- C. Outdoor and Indoor/Outdoor rated cables must include an outer jacket to provide protection from hydrocarbon fuels.
- D. Potassium acetate is used as a de-icing agent. Outdoor and Indoor/Outdoor rated cables must have outer jackets that provide proper protection from this agent.
- E. The fiber optic patch panels as manufactured by Corning Cable Systems, model number WCH-06P with ST type connectors and panels must meet FAA requirements. For multi-mode applications the patch panels would be equipped with ST connector panels for 62.5 μm multi-mode cables. (Type G5).
- F.

19.02 REQUIREMENTS

- A. Introduction. The fiber optic cable specified herein will be an integral part of a FAA on-airfield communication and NAVAIDS system. The requirements defined herein are intended to result in a cable with reliability appropriate to the critical nature of the application.
- B. Materials. If material for a cable component is stipulated, it must be as specified herein. If the material for a cable component is not stipulated, it must be entirely suitable for the application. The manufacturer must certify that all synthetic substances were produced from virgin compounds.

- C. Workmanship. The cable must be free of any imperfections that may affect its performance or survivability in the environment.
- D. Fiber and cable.
1. The fiber optic cable must consist of, but not be limited to, the following components:
 - a. Tight buffered or loose tube optical fibers, as specified
 - b. Rod fillers
 - c. Synthetic yarn strength member
 - d. Protective outer jacket
 - e. Optical fiber
 2. The tight buffered optical fiber must consist of a central glass optical fiber surrounded by a primary polymer buffer and an optical tight fitting secondary, thermoplastic polymer buffer. The primary diameter of the protective coating must be $250 \pm 15 \mu\text{m}$ and the secondary buffer must be $900 \mu\text{m}$ as determined by FOTP 173. The protective coating must be easily removed by common chemical or mechanical means.
 3. Tight buffered cable must be assembled by heliacally stranding 12 tight buffered optical fibers and rod fillers around a central rod filler.
 4. For loose-tube optical cable applications requiring more than 6 fibers, the fiber cable shall be organized in subgroups of 6 individual fibers. The cable shall consist of dielectric central member, color-coated subgroup cables, additional dielectric strength members, and a ripcord covered by an outer jacket. Each subgroup cable consists of 6 individual sub-cables with a filled color-coded buffer tube. Each sub-cable shall consist of the main fiber strand with $250 \mu\text{m}$ fiber coating. The cable shall have a water swellable aramid yarn water blocking system to fill all voids and indices to prevent the intrusion of moisture.
 5. Rod fillers; each rod filler must consist of a central dielectric strength member surrounded by an extruded elastomeric polymer coating.
 6. Synthetic yarn strength member. The synthetic yarn strength member must be heliacally laid directly over the stranded cable core. The strength member must be composed of individually and precisely tensioned elements such that the tensile load is equally shared by each element.
 7. Outer jacket. The outer jacket must consist of an extrusion of flexible Fluor polymer plenum material having a nominal wall thickness of 0.6

millimeters and a minimum wall thickness of 0.48 millimeters at any point. The outer jacket must be extruded directly over the strength member layer. Tape or other materials between the jacket and core are specifically not allowed. The outer jacket must be smooth and free from holes, splits, blisters or other surface flaws

8. Ripcord. The cable must contain a non-wicking aramid yarn beneath the cable jacket to serve as a ripcord for jacket removal.
9. Cable marking. The outer jacket must be surface printed with the manufacturer's identification and required UL markings. The marking must include the date of manufacture, manufacturer's part number and sequential numerical meter marks.
10. Colors. The buffered coatings must be color coded in accordance with ANSI/TIA/EIA-598A. Multi-mode fiber jacket to match FAA existing multi-mode cables - black. The color of the markings on the cable must contrast with the cable jacket color. Primary colors must be in accordance with ANSI/TIA/EIA-STD-RS-359.
11. Loose tube multi-mode fiber optic cable only. Indoor/outdoor fiber optic cable will be an all-dielectric, loose tube, with water swellable aramid yarn water blocking construction, fiber optic cable. Each fiber will be multi-mode, graded index, 62.5/125 μm diameter (core/clad).
12. Multi-mode optical fiber. The multi-mode optical fiber must be a fully graded refractive index profile with a transmission window at 1300 nm, of all silica based composition.
 - a. Core-cladding concentricity (offset). The core-cladding offset as determined by the method described in FOTP 176, must not exceed 3 μm .
 - b. Core diameter. Each multi-mode optical fiber must have a core diameter of 62.5 \pm 3 μm , as determined by FOTP 58A.
 - c. Zero-dispersion wavelength. The zero-dispersion wavelength must be within the range 1297 nm to 1316 nm as determined by FOTP 168A. The median zero-dispersion wavelength must be 1300 \pm 3 nm.
 - d. Zero-dispersion slope. The maximum for the zero-dispersion slope must not exceed 0.101 ps/ $\text{nm}^2\text{-km}$ as determined by FOTP 168A.
 - e. Attenuation. The attenuation of the cabled fiber, as determined by FOTP 61A must not exceed 1.25dB/km at 1300 nm at 68 degrees F, and bandwidth will be a minimum of 500 MHz at 1300 nm.

The attenuation profile as measured using an Optical Time Domain Reflectometer (OTDR) must be substantially uniform.

Localized variations/discontinuities in the OTDR profile must not exceed 0.2 dB as determined by FOTP 59. The attenuation resulting from the hydroxyl ion absorption must not exceed the attenuation at the nominal zero dispersion wavelength by more than 3 dB as determined by FOTP 61A.

Each fiber attenuation will not exceed 3.5 dB/km nominal, measured at room temperature at 850 nm and bandwidth will be a minimum of 500 MHz/km at 850 nm.

- (1) Tensile Load. The cable will with stand a maximum pulling tension of 400 lb. during installation, short term and 100 lb. upon installation, long term.
 - (2) Temperature Range. The shipping, storage installing and operating range of the cable will be 14 degrees F to 140 degrees F, (-10 degrees C to 60 degrees C).
 - (3) Cable Performance Tests. The cable will meet or exceed all ANSI or EIA minimum performance measures for Fiber Optic Test Procedures (FOTP) requirements, such as fluid penetration, compound drip, compressive loading resistance, cyclic flexing, impact, tensile loading and bending.
- f. Temperature dependence of attenuation. The temperature dependence of attenuation, as determined by FOTP 3A, must not exceed 0.5 dB/km over the temperature range -40 degrees F + 140 degrees F.
 - g. Cladding diameter. The cladding diameter must be $125 \pm 2.0 \mu\text{m}$ as determined by FOTP 176.
 - h. Non-circularity. The non-circularity of the core must not exceed 5.0% as determined by FOTP 176.
 - i. Tensile strength. The tensile strength of the fiber as measured by FOTP 31B, must not be less than 0.69 GN/m^2 .

E. Mechanical Performance

Multi-Mode fiber:

1. Un-spliced length. The un-spliced length on delivered reel must be sufficient to provide a continuous run between RTR-C and the Runway 28 ALSF shelter with the required amount of slack in each structure as well as the necessary length to terminate inside each shelter.
2. Central strength member. The central strength member of the cable must be totally dielectric and fully compatible with other cable

components. Reference ICEA S 87-640-1992, Section 9.1.6.

3. Fiber proof test. All fibers must be subjected to a minimum proof stress of 0.7 Gpa (100 kpsi).
4. Fiber strip ability. Both the primary and secondary fiber buffer layers and outer jacket must be easily removed with commercially available mechanical stripping tools.
5. Installation bending radius. Bending radius of 20 times cable diameter. The installation bending radius should be specified as a maximum allowable value. Cables with a manufacturer recommended smaller installation bending radius are acceptable.
6. Minimum tensile strength. The cable must withstand a minimum installation tensile load not less than 1801 Newtons (N) and not less than 450 N continuous tensile load.
7. Impact resistance. The cable must withstand an impact force 2000 times with 1.6 N-m, per the requirements of ANSI/TIA/EIA-RS-455 (FOTP-25A).
8. Crush resistance. The cable must withstand a compression load of 2000 N/cm, per the requirements of ANSI/TIA/EIA-RS-455 (FOTP-41A).
9. Cyclic flex resistance. The cable must withstand cyclic flexing 2000 times per the requirements of ANSI/TIA/EIA-RS-455 (FOTP-104).

F. Environmental Performance

Multi-Mode fiber:

1. Cable storage. There must be no deterioration of the cable, fiber integrity or optical performance due to outdoor storage of the cable on the shipping reel.
2. Temperature. The cable must comply with the optical cable and mechanical performance requirements over the operating temperature range of -40 degrees Celsius to +70 degrees Celsius. The cable must not be damaged in any way when exposed to the storage temperature range of -40 degrees Celsius to +80 degrees Celsius. The actual temperature of the cable for installation will be -10 degrees Celsius to +60 degrees Celsius.
3. Humidity. The cable must comply with the optical and mechanical performance requirements of up to 95% relative humidity (non-condensing) when subjected to moisture resistance conditioning according to method 106B of MIL-STD-202 except that the specimen must not be vibrated.
4. Moisture resistance. Optical and mechanical performance must not be degraded and the cable must not be damaged in any way by

immersion in ground water.

5. Fungus resistance. The outer jacket material used in construction of this cable must be fungus inert as described in requirement 4 of MIL-HDBK-454.
 6. Sunlight / UV resistance. The outdoor outer jacket material must be as determined in accordance with MIL-SDT-810, method 505.
 7. Flame retardancy. The cable must be UL listed type OFNR or OFNP as per the requirements of UL standard 910.
 8. Chemical resistance. The outer jacket material must exhibit chemical resistance to most de-icing fluids used at airports such as potassium acetate, hydrocarbons and halogenated solvents. This material must be resistant to such chemicals as crude oil, diesel fuel, gasoline, jet fuel, kerosene, oils or Skydrol 500.
 9. Quality standard. The manufacturer must provide proof of ISO 9001 certification.
- G. The 62.5 μm Multi-mode Indoor/Outdoor Riser Rated Loose tube Fiber Optic Cable
1. The fiber shall use a carefully controlled refractive index profile to achieve low attenuation and high bandwidth at both operating wavelengths, the fiber bandwidth shall meet the standards for FDDI and support Ethernet, Fast Ethernet, Token Ring, ATM and FDDI applications.
 2. The buffer tubes shall be compatible with standard hardware, cable routing and fan-out kits.
 3. The cable shall be designed for point-to-point applications as well as midspan access, provide a high-level of protection for fiber installed in the outside plant environment.
 4. This cable is designed to connect equipment or facilities that are separated by an outdoor type environment.
 5. It shall be suitable for indoor/outdoor conduit or tray installations.
 6. Individual fiber strands and or groupings shall be color coded per ANSI/TIA/EIA guidelines.
- H. Fiber Optic Connectors
1. ST Fiber Optic Connectors:
 - a. Provide factory-terminated connectors with pigtails.
 - b. The connector must be available for multi-mode fiber optic cables.
 - c. The connector must utilize a zirconia ferrule for fiber alignment.

- d. The connector must be Bellcore, TIA/EIA and IEC compliant.
 - e. The connectors must meet the following requirements:
 - (1) Average loss for multi-mode fiber; 0.3 dB.
 - (2)
2. Patch Cords:
- a. Provide factory-terminated connectors fiber patch cords consisting of buffered, graded index fiber with 125 micron cladding. Core size to match application requirements. The 900 micron fiber coating must be covered by aramid yarn and a jacket of flame retardant PVC. Provide factory-terminated connectors with ceramic ferrules. Provide the connector type (ST) as called for in this specification or on the drawings.
 - b. Provide two-strand riser rated zipcord style cords for all duplex patch through and equipment connections. Provide single strand cords for single equipment connections.
 - c. Provide the quantities and length of patch cords required to make orderly, manageable connections between all patch panels and equipment being cross connected.
 - d. Mated connectors loss; 0.2 dB typical, guaranteed maximum of 0.5 dB, for 500 insertions.
 - e. Operation temperature; -40 degrees Celsius to +80 degrees Celsius and less than 0.3 dB change.
 - f. Cable retention; 20 lb. minimum for less than 0.2 dB change.
3. Grounding System and Conductors:
- a. Bounding and Grounding
 - (1) Communication bonding and grounding must be in accordance with the Chicago Electric Code, NFPA and FAA Specification FAA-019e.
 - (2) Horizontal cables and equipment must be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.
 - (3) Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment.
4. Fiber Optic Pigtail:
- a. Fiber optic pigtails will be single-mode or multi-mode, factory made, buffered and strengthened with aramid yarn. Pigtails will contain one fiber, and an ST connector on one end. Multi-mode pigtails must be orange in color. Single-mode pigtails must be yellow in color.

19.03 QUALITY ASSURANCE

- A. The fiber optic cable must meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods are defined in EIA-STD-RS-455:
1. Fiber dimensions
 2. Attenuation
 3. Bandwidth
 4. Numerical aperture
 5. Fiber proof test
 6. Cable bending
 7. Tensile load
 8. Impact resistance
 9. Crush resistance
 10. Attenuation vs. temperature
- B. Quality control provisions. The manufacturer must comply with the requirements of ANSI/ISO/ASQC 9003. All tests must be performed by the Contractor and must be witnessed by the Engineer, CDA, and FAA. If the Engineer, CDA, and FAA's witnessing is waived, the Contractor must furnish three copies of certified test data. The cable will not be accepted by the Engineer, CDA, and FAA until the test data, certified by a properly authorized official of the Contractor to be true, correct, and complete and satisfying the specification requirements, has been submitted to and approved by the Engineer, CDA, and FAA. All tests must be performed at the time of manufacture. Any reel of cable or specimen offered for inspection but failing to meet the requirements of the test may not be re-offered for a retest without approval of the Engineer, CDA, and FAA.
- C. Inspector's Samples. One 25 meter length of cable must be cut from the end of reels to be selected randomly, with a maximum sampling of one sample per each 15 km. A minimum sample for orders less than 15 km is one sample. A sample must be taken at random from each lot of five reels, for a total of ten samples. Each sample will be identified by reel number, Contract/order number and specification number. The reels must be numbered sequentially for this purpose in the order of manufacture.
- D. Cable Testing:
1. Testing must be in accordance with Standard FAA-E-2761c on all fiber optic cables.
 2. Fiber. All fibers in the finished cable must be tested at the factory, after delivery to the site, on the reel prior to installation, during and

after installation and in accordance with the definitions and procedures specified in the EIA/TIA-455 Fiber Optic Test Procedures (FOTP's) to determine if the fiber complies with the specifications. Each optical fiber will be proof tested by the fiber manufacturer at a minimum stress of 350,000 kPa. The fiber manufacturer must provide a certificate of compliance for the following properties where indicated by a "yes":

	Multi-mode	Single-mode
a. Core Diameter	Yes	---
b. Cladding Diameter	Yes	Yes
c. Protective Coating Diameter	Yes	Yes
d. Core-Cladding Concentricity	Yes	Yes
e. Core Non-Circularity	Yes	---
f. Cladding Non-Circularity	Yes	Yes
g. Tensile Strength	Yes	Yes
h. Numerical Aperture	Yes	---
i. Zero-Dispersion Wavelength	Yes	Yes
j. Zero-Dispersion Slope	Yes	Yes
k. Bandwidth	Yes	---
l. Mode-Field Diameter	---	Yes
m. Cut-Off Wavelength	---	Yes
n. Sheath Material Properties	Yes	Yes
o. Specification 16125		
Mechanical Performance	Yes	Yes
Environmental Performance	Yes	Yes
3. Cable assembly test. The tests described elsewhere in these specifications and FAA-E-2761C, and must be performed on all fibers of every reel.		
a. Optical attenuation at manufacturer. The optical attenuation of		

the cable must be validated in accordance with the requirements of this specification and fiber optic cable specification FAA-E-2761C on all fibers of every reel of finished cable. The test results for each reel must be provided upon delivery in a sealed waterproofed envelope. All optical fibers in cables must be 100 percent attenuation tested. The attenuation must be measured at 1310 nm and 1550nm for single-mode fiber optic cables. The attenuation must be measured at 850 nm and 1300 nm for multi-mode fiber optic cables. The contractor must submit manufacturer's shop test report.

- b. Optical bandwidth. The -3dB end-to-end optical bandwidth of all fibers in all multi-mode cables shall be determined by FOTP 30B. For lengths greater than 1 km, the required -3dB end-to-end bandwidth shall be calculated from:

$$BW_{-3dB} \geq 1,000 \text{ Mhz}/(\text{length in kilometers})^{.85}, \\ (62.5/125\mu\text{m})$$

- c. Temperature dependence of attenuation. The temperature dependence of attenuation must be determined by FOTP 3 (for 48 hours or when it is ensured that the cable has uniformly reached the test temperature) on all fibers of one reel of cable selected at random. Measurements must be made at -40 degrees F and + 140 degrees F \pm 3.5 degrees F.
- d. Sheath thickness. The thickness of the interior and/or the exterior sheath must be as specified in section 3.4.5.6, 3.4.5.7, and 3.4.5.8 of specification FAA-E-2761C when measured in accordance with ASTM D4565, section 7.
- e. Cable flexing. The specimen(s) selected from the sample specified in 2.03,C must be prepared in accordance with FOTP 37A, except that a mandrel having a diameter up to 20 times the cable diameter will be permitted. Test condition D 32 degrees F and 104 degrees F of Table I of FOTP 37A will suffice, as will Test Level 2 (10 mandrel turns) of Table III. The test mass must be in accordance with Table II.
- f. Water intercepts tests. Test specimens selected randomly from the sample specified in 2.03,C must be tested per FOTP 82B. There must be no evidence of water leakage.
- g. Cable pulling capacity test. This test must be performed in accordance with FOTP 33A. This test must be a type acceptance test on a production run basis.
- h. Sheath material properties certification. The manufacturer must certify that the extrusion process used for application of the sheathing compound complies with the recommendations of the compound supplier.

- i. Crush resistance test. Test specimens taken at random must be subjected to the crush force specified. The optical attenuation must not change from before the test to after the test in the tested sample.
 - j. Impact resistance test. Test specimens taken at random must be subjected to the impact force specified. The optical attenuation must not change form before the test to after the test in the tested sample.
4. The fiber optic cables and related equipment must be the products of approved manufacturers. Fabrication of the fiber optic cables and related equipment must utilize the most advanced commercial materials and manufacturing process. Manufacturer must be ISO 9001 and TL-9000 certified.
 5. Fiber optic cable installation must be performed by experienced fiber optic cable installers who must have been regularly engaged in the installation of fiber optic cables for the last five (5) years at the minimum.
 6. Fiber optic cable splicing and terminations must be performed by experienced fiber optic cable installers who must have been regularly engaged in splicing and termination of fiber optic cables for the last five (5) years at the minimum.
 7. The contractor must retain the services of the fiber optic cable manufacturers technical representative to certify that the fiber optic cable installation is in accordance with the manufacturer's installation requirements.
 8. The contractor must retain the services of an independent testing firm who must perform acceptance testing of the fiber optic cable installation. The test firm must have experience in the inspection and testing of cables of the specified type and must be a member company of NETA.

19.04 Preparation for Delivery

- A. Cable length per reel. The specified length of cable must be delivered on a non-returnable reel in one continuous length within a tolerance of 0%, +10%, unless otherwise specified.
- B. Top and bottom ends of the cable must be available for testing.
- C. Cable protective wrap. The outer layer of cable must be completely covered with a reflective and water resistant wrap such as white water-resistant paper, white plastic, or aluminum foil.
- D. Reel construction. Reels must have been constructed from previously-unused wood and in accordance with NEMA WC-26, Wire and Cable Packaging. Plywood reels are not acceptable. The reel must protect the cable from all shipping hazards and must provide long-term outdoor-storage

protection from wind, sand, rain, snow and sunlight. The cable reels must also comply with the requirements stipulated in ICEA S-87-640 paragraph 7.4.4, subparagraphs 7.4.4.1 through 7.4.4.4 inclusive, and paragraph 7.4.7. If access to the inner end of the cable is via a slot in the reel flange, the slot must be covered with a rust-resistant metal plate. The plate must not be less than 18-gauge. Each reel must have a weather resistant reel tag attached identifying the reel and cable.

- E. Reel lagging. The reel must be lagged with nominal two-inch by four inch #2 common lumber from edge-to-edge around the full circumference of the reel. The lagging must be strapped with two or more equally spaced steel bands.
- F. Reel marking. The Contractor's name, Contract number under which the cable was purchased, NSN, actual length and type of cable, and cable installation temperature range (prominently marked), must be embossed or printed with indelible ink onto aluminum plates and securely fastened to each outer reel-flange with nails or screws. The minimum font size for reel markings must be 28.

PART 20 CONSTRUCTION METHODS

20.01 CABLE INSTALLATION

- A. General. The fiber optic cable must be installed in continuous runs between FAA facilities or enclosures as shown on the plans. Splices will not be allowed. The cable must be terminated at locations as shown on the plans and as directed by the Engineer, CDA, and FAA.
 - 1. Cable Minimum Bend Radius. For static storage, the cable must not be bent at any location to less than 20 times the diameter of the cable outside diameter or as recommended by the manufacturer. During installation, the cable must not be bent at any location to less than 20 times the diameter of the cable outside diameter or as recommended by the manufacturer.
 - 2. Cable Slack. Loops of multi-mode fiber optic cable must be provided in each handhole and manhole as shown on the plans, at the top of each conduit riser, and at each enclosure according to the following requirements. The minimum slack amounts must be as follows:

Slack Location	Slack Cable Length (Feet)
Junction Box (24"x24")	15.0
Handhole	24.0 horizontal coil
Conduit Riser	13.0
Manhole	42.0 horizontal coil

- a. The slack cable length for each multi-mode fiber optic transmission system loop must be coiled one and one half times around the inside

perimeter of the manhole or handhole, laid and supported on the rack arms of the manhole or handhole.

3. Cable Termination. Field cable must terminate in the distribution enclosure as directed by the Engineer, CDA, and FAA.
- B. Installation in Conduits. All multi mode fiber optic cables shall be installed in orange 1" inner duct. The Contractor must compensate for inner duct elongation due to installation as described in Section L-110. The fiber optic inner duct must be installed in a 4" conduit as shown on the Plan Set. Use only (1) 12 strand fiber optic cable per 1" inner duct. A suitable cable feeder guide must be used between the cable reel and the face of the conduit to protect the cable and to guide it into the conduit off the reel. The cable must be carefully inspected for jacket defects. If defects are noticed, the pulling operation must be stopped immediately and the Engineer, CDA, and FAA must be notified. The fiber optic cable minimum bend radius must not be exceeded during installation. After installation, no fiber optic cable shall be under tension in the manholes and handholes nor within the ductbank between manholes and handholes.

Precautions must be taken during installation to prevent the cable from being kinked or crushed. A pulling eye must be attached to the cable and used to pull the cable through the conduit. A pulling swivel must be used to eliminate twisting of the cable. As the cable is played off the reel into the cable feeder guide, it must be lubricated with a type of lubricant recommended by the cable manufacturer. The lubricant used must be of water based type and approved by the cable manufacturer. Dynamometers of break away pulling swing must be used to ensure that the pulling line tension does not exceed the installation tension specified by the cable manufacturer. Maximum length of cable pulling tensions must not exceed the cable manufacturer's recommendations. The mechanical stress placed on a cable during installation must not be such that the cable is twisted or stretched. The pulling of the cable must be hand assisted at each enclosure. The cable must not be crushed, kinked or forced around a sharp corner. Sufficient slack must be left at each end of the cable to allow proper cable termination. At each enclosure, manhole or handhole the cable must be visibly marked/tagged as directed by the Engineer, CDA, and FAA.

- C. The Contractor must test the fiber optic cable on the reel at the construction site as specified in 2.03(D) in the presence of the Engineer, CDA, and FAA and FAA prior to installation.
- D. The Contractor must test the fiber optic cable for each segment after installation and must certify and demonstrate to the FAA and the Engineer, CDA, and FAA that it meets all the performance requirements. The cable strand readings must not exceed a 0.5 dB difference from the least to the highest reading per cable. Contractor must test the performance of each strand on every fiber optic cable segment in both directions of transmission and provide (3) three copies of the test results to the FAA in both electronic

and loose leaf hard copy formats. The following tests shall be performed and the associated documentation provided:

1. Factory tests – optical attenuation, cable assembly test (refer to checklist).
 2. On-site pre-installation reel tests – Optical Time Domain Reflectometer (OTDR).
 3. Installed cable tests – OTDR and optical attenuation
- E. The fiber optic cable must be tagged at every manhole, junction box, enclosure and facility with the named designations identified on the drawings. Within the lower level concourse tunnels, fiber cables not routed within conduit must be tagged every 50' minimum. The tagging identification must meet CDA Design Criteria Section 2, Airside for Single-Mode Fiber except for multi-mode they are orange color and as directed by the Engineer, CDA, and FAA. Only manufacturer pre-printed labels for the fiber optic cable and tracer wire will be accepted.
- F. Installation Temperature. No fiber optic cable shall be installed in a 12 hour period during which the National Weather Service forecasts temperatures at or below the cable's minimum installation temperature at O'Hare International Airport.

PART 21 METHOD OF MEASUREMENT

21.01 MEASUREMENT

- A. The fiber optic cable will be measured for payment per linear foot in place. Cable will be measured horizontally and vertically between the changes in direction, including slack cables and the cable in the vertical conduit riser and inside the FAA facility. All testing and documentation required per this specification is included in this pay item.
- B. Fiber optic patch panels will be measured by each patch panel installed complete, connected, tested, ready for operation and accepted as a completed system by the Engineer, CDA, and FAA. Patch cords connecting the patch panel to the final terminal will be supplied by the contractor and installed by the FAA. Patch cords are included in the patch panel pay item.

PART 22 BASIS OF PAYMENT

22.01 PAYMENT

- A. Fiber optic connectors will not be paid for separately but will include all connectors of the type and size specified and shown on the Plans, and will be considered incidental to the cost of the specified fiber optic cable.
- B. Fiber optic cable will be paid for at the Contract unit price per linear foot for Fiber optic cable of the type, size and number of fibers specified.

The lengths of slack cable allowed and the vertical cable in the FAA facilities and the cable in the vertical conduit riser will be paid for at the Contract unit price per linear foot for Fiber optic cable of the type, size and number of fibers specified.

- C. The cable warning tags and termination will be included in the cost of the fiber optic cable. All testing and documentation required per this specification is included in this pay item.
- D. Fiber optic patch panels will be paid for at the Contract unit price for each patch panel installed complete, connected, tested, ready for operation and accepted as a completed system by the Engineer, CDA, and FAA. Patch cords connecting the patch panel to the final terminal will be supplied by the contractor and installed by the FAA. Patch cords are included in the patch panel unit price.
- E. Payment will be made under:
 - 1. 12 STRAND, TYPE B, MULTI-MODE FIBER OPTIC CABLE, OUTDOOR, per linear foot.
 - 2. MULTI-MODE FIBER OPTIC PATCH PANEL, 72 PORT, per each

FAA FOTS Multi-Mode Fiber Optic Cable Specification Test Requirement Checklist

01.	<p>Manufacturer to provide certificate of Specification 16125 compliance for:</p> <ul style="list-style-type: none"> Core Diameter Cladding Diameter Protective Coating Diameter Core-cladding Concentricity Core Non-circularity Cladding Non-circularity Tensile Strength Numerical Aperture Zero-Dispersion Wavelength Zero-Dispersion Slope Bandwidth Sheath Material Properties Specification 16125 Mechanical Performance Specification 16125 Environmental Performance
02.	Manufacturer must validate the optical attenuation on all fibers of every reel of finished cable by power measurement per FAA-E-2761c at the factory prior to shipment at 850 nm and 1300nm wavelength (16125, 2.03, d, 3.a)
03.	Manufacturer to test all fibers of every reel for optical bandwidth (16125, 2.03, d, 3.b).
04.	Manufacturer to test all fibers of one reel of cable selected at random for temperature dependence of attenuation (16125, 2.03, d, 3.c.).
05.	Manufacturer to test specimen selected from sample for cable sheath thickness (16125, 2.03, d, 3.d)
06.	Manufacturer to test specimen selected from sample for cable flexing (16125, 2.03, d, 3.e).
07.	Manufacturer to test specimen selected randomly from sample for water intercept tests (16125, 2.03, d, 3.f).
08.	Manufacturer to test on a production run basis cable pulling capacity test (16125, 2.03, d, 3.g).
09.	Manufacturer to test specimen selected from sample for cable sheath material properties certification (16125, 2.03, d, 3.h).
10.	Manufacturer to test specimen selected randomly from sample for crush resistance test (16125, 2.03, d, 3.i).
11.	Manufacturer to test specimen selected randomly from sample for impact resistance tests (16125, 2.03, d, 3.j).
12.	Contractor must validate the optical attenuation on all fibers of every reel of finished cable by OTDR Test trace per FAA-E-2761C at the site prior to installation in the presence of the Engineer, CDA, and FAA/FAA at 850nm and 1300nm wavelength.
13.	The Contractor must test the fiber optic cable for each segment after installation and must certify and demonstrate to the FAA, the Engineer, and the CDA that it meets all the performance requirements of Specification 16125 and FAA-E-2761C. Contractor must validate the optical attenuation on all fibers of every segment of installed cable by OTDR Test trace per FAA-E-2761C at the site in the presence of the Engineer, CDA, and FAA/FAA at 850nm and 1300nm wavelength. OTDR measurements to be made bidirectional with the results averaged where splices occur in a segment between nodes.
14.	Contractor must perform a power attenuation test on each fiber bi-directionally for each segment of cable.
15.	The cable strand reading must not exceed a 0.5 db difference from the least to the highest strand reading per cable.

ELECTRICAL IDENTIFICATION FOR FAA RELOCATIONS (SECTION 16195)

PART 23 GENERAL

23.01 SECTION INCLUDES:

- A. Work under this section is subject to the requirements of the Contract Documents.
- B. Furnish and install Electrical Identification as shown on the Drawings and as specified herein, including but not limited to the following:
 - 1. Conduit markers
 - 2. Wire / Cable Markers.
 - 3. Warning Tape.
 - 4. Danger Signs.
 - 5. Equipment Identification.
- C. For the purposes of this Specification the term "Cable" must apply to any type of conductor mentioned in the Contract Documents.

23.02 RELATED WORK:

- A. As specified in the following special provisions:
 - 1. BASIC ELECTRICAL REQUIREMENTS FOR FAA RELOCATIONS (SECTION 16010)
 - 2. BASIC MATERIALS AND METHODS FOR FAA RELOCATIONS (SECTION 16100)
 - 3. FIBER OPTIC CABLE AND EQUIPMENT FOR FAA RELOCATIONS (SECTION 16125)
 - 4. ELECTRICAL IDENTIFICATION FOR FAA RELOCATIONS (SECTION 16195)
 - 5. GROUNDING FOR FAA RELOCATIONS (SECTION 16452)
 - 6. MALSR ELECTRICAL (SECTION 16620)
 - 7. ALSF-2 ELECTRICAL (SECTION 16630)

23.03 TESTING FOR FAA RELOCATIONS (SECTION 16950) REFERENCES:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.03.

23.04 SUBMITTALS:

- A. The Contractor must submit data to the Engineer, CDA, and FAA prior to purchasing and installation. The data must include but not be limited to the following:
 - 1. Catalog cuts and major electrical equipment manufacturers' Drawings must include, but is not limited to, relays, meters, current and potential transformers, disconnect switches, fuses, contractors, lighting and more.
 - 2. Complete rating data for all equipment must be provided.
 - 3. Instruction books, operation and maintenance manuals with spare parts must be provided.
- B. Submit samples of Conduit markers, cable markers and Phenolic Tags.
- C. Submit a nameplate log which must clearly indicate the exact wording for each nameplate.
- D. Shop Drawings - See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 10.4 B.

23.05 QUALITY CONTROL:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.05.

23.06 DELIVERY STORAGE AND HANDLING:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.06.

23.07 WARRANTIES AND GUARANTEES:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.07.

23.08 EXTRA MATERIALS AND SPARE PARTS:

- A. None required

23.09 ENVIRONMENTAL REQUIREMENTS:

- A. See Division 13 for these requirements.

23.10 SPECIAL REQUIREMENTS:

- A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.
- B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.

PART 24 PRODUCTS

24.01 ACCEPTABLE MANUFACTURERS:

- A. Products of one of the following Manufacturers will be acceptable (for each type marker):
1. Alarm Supply Co., Inc.
 2. Brady, W.H. Co.
 3. Calpico Inc.
 4. Cole-Flex Corp.
 5. Direct Safety Co.
 6. George-Ingraham Corp.
 7. Griffolyn Company
 8. Ideal Industries, Inc.
 9. LEM Products, Inc.
 10. Markal Company
 11. National Band and Tag Co.
 12. Panduit Corp.
 13. Garfoplast.

24.02 UNDERGROUND CABLE MARKERS:

- A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than one (1) type is specified for an application, selection is installer's option, but provide only one selection for each application.
- B. Cable markers for all underground cables must be vinyl tags, with the lettering etched through the outer layer. Tags must have the lettering engraved through the outer layer exposing the second layer. The edges of each tag must be beveled. Markers must be held in place with Nylon, self-locking cable ties. Each marker must be provided with a hole at each end of the marker for the purposes of attaching the marker to the cable.
1. The cable markers must be white vinyl with black letters. Letters must be a minimum of 3/8 inch in height.
- C. Cable identification must be the circuit number and the panel designation it is powered from. Where the cable originates from a piece of equipment, which is not a panel, the marking must be the item being fed and the source, i.e. " EF-1 MCC-1 ".

24.03 UNDERGROUND LINE MARKERS:

- A. Manufacturer's standard permanent, bright-red, continuous-printed plastic tape, intended for direct-burial service, not less than 6 inches wide x 4 mils thick. Provide tape with printing which most accurately indicates type of buried electrical service. Tape must be of the Aluminum Foil Polyethylene Laminate type which must be detectable when buried.

24.04 INTERIOR CABLE MARKERS:

- A. Cable markers must be installed on both ends of all conductors. Self-adhesive, self-laminating, or heat shrink tubing or plastic bead type must be used. All markers must be mechanically printed. Cable markers must be rated for the environment in which they are placed. Acceptable manufacturers will be Brady, 3M, Panduit or Garfoplast.
- B. Circuit identification must be per the Contract Drawings. Should the Drawings not specify the circuit identification the following system must be used:
 - 1. For branch circuit wiring from receptacle/lighting panels the circuit identification must be the panel number and the circuit number.
 - 2. For circuiting from distribution panels the circuit identification must be the panel number and the circuit number.
 - 3. For power conductors from MCC's the identification must be the MCC designation, the item being supplied and the phase designation. Control wiring must be per the wiring diagrams.
- C. Conductor color coding must be done using tape as specified elsewhere in the Contract Documents. Provide color coding for all conductors which do not come with factory applied colors.

24.05 CONDUIT MARKERS:

- A. Conduit tags must be stainless steel, grade 316 minimum or brass. Tags must have the identification either stamped in or embossed in the material. Tags must be fastened to the conduit with either stainless steel wire or with nylon, self-locking cable ties. For interior, dry locations nylon tags which are mechanically printed may be used.
- B. Conduit tags for underground use must be as described above. Where it is not practical to attach the tag to the conduit, i.e., in handholes and manholes, the tags must be fastened to the structure at the point where the conduit enters the structure. The Contractor may use a single large plate type marker for this purpose. The marker must accurately depict the conduits and their identification. The identification must be attached using anchors as described in other parts of the Contract Documents.

24.06 WARNING/DANGER SIGNS:

- A. Provide manufacturer's standard "DANGER" signs of rigid Polyethylene; of standard, red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision, with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, etc.
- B. Provide "Warning" signs, as required, of rigid Polyethylene, colors as required by OSHA.
- C. Signs must be attached with Stainless Steel screws. Warning/Danger signs must not be of the adhesive type for attachment to doors or walls.

24.07 EQUIPMENT IDENTIFICATION:

- A. After finish painting is completed, the Contractor must provide white with black core laminated phenolic nameplates with 1/4 inch minimum lettering etched through the outer covering. Inscription must be made with all upper case letters and must be the same inscriptions as shown on the Drawings or as directed by the Engineer, CDA, and FAA.
 - 1. All major electrical equipment must be so identified, including motor starters, disconnect switches, panels, switches, etc.
 - 2. Disconnect switches serving feeders and overcurrent protective devices mounted in a switchboard must be so identified.
 - 3. Embossed self-adhering plastic tape labels will not be accepted.
 - 4. Use stainless steel screws, except where contact-type permanent adhesive may be required when screws cannot or should not penetrate substrate.
 - 5. For Fire Alarm Systems provide white with red core laminated phenolic name plates.
 - 6. For Emergency Power equipment provide red with white letters.
 - 7. The Contractor must take care when attaching the identification so that the NEMA rating of the equipment is not violated.

24.08 LETTERING AND GRAPHICS:

- A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

- B. Identification markings on signs and markers must not be done with pens, pencils, crayons, magic markers, paint, dymo-labels, etc.
- C. Identification on small boxes, i.e., 4 inch square and 4-11/16 inch boxes may be done with a permanent marker in neat and legible block printing. Black markers must be used for this purpose. The Contractor must identify the circuits contained and the panel(s) of origin.

24.09 TERMINAL IDENTIFICATION:

- A. Terminal strips must be identified by using markers supplied by the terminal manufacturer. Whenever possible they must be mechanically printed. When this is not possible the strips must be marked in neat and legible block lettering using a permanent marking system acceptable to the terminal strip manufacturer. The terminal marking must be the wire number attached to that terminal.

24.10 PULL BOX IDENTIFICATION:

- A. Identification markers for pull boxes, junction boxes, etc. must be of the polyester film type, self adhesive and pre-printed. The marker must contain the highest voltage level contained within that box. The marker must be yellow with black letters and the lettering must be visible from the floor.
- B. The box must have a phenolic nameplate, white with black letters, affixed to the box with stainless steel screws with the box identification. Each box must have a identifying designation that must be shown on the Drawings.

24.11 CABLE TIES:

- A. Cable ties must be fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50 lb. minimum tensile strength, and suitable for a temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color coding.
- B. Acceptable manufacturers will be Thomas & Betts Co., Brady Co. and Panduit.

24.12 WIRE IDENTIFICATION IN EQUIPMENT:

- A. The wire identification for manufactured equipment must match the wire identification shown on the manufacturers wiring diagrams. All wires must be identified. The manufacturer must use product as specified in the Contract Documents.
- B. For custom built equipment the wire identification must match the wire identification shown on the assemblers approved Shop Drawings. All wires must be identified.
- C. In no case must a wire number change designations as a result of termination at a terminal.

- D. Where multi-conductor cables are used the cable must be identified as well as each conductor contained within that cable.

PART 25 EXECUTION

25.01 APPLICATION AND INSTALLATION:

- A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, requirements of Chicago Electrical Code and the Contract Documents.
 - 1. Where identification is to be applied to surfaces which require a specific finish, install identification after completion of the finish. The Contractor must take all precautions to avoid damaging the finish. Any damage must be repaired in a manner acceptable to the Engineer, CDA, and FAA.
 - 2. Comply with governing regulations and requests of governing authorities for identification of electrical work.
- B. The Contractor must provide a typewritten directory of circuits in lighting and power panels. The Contractor must clearly indicate the purpose of each circuit, i.e., lighting, receptacles, water cooler, etc. and must indicate the location of the supplied equipment.

25.02 CONDUIT, WIRE, CABLE AND BUS IDENTIFICATION:

- A. When not shown on the Contract Drawings the Contractor must indicate on his/her field marked set of Drawings, as required by the Contract Documents, the conduit identification.
- B. Each cable must be labeled at all terminals and at all accessible points in equipment, panelboards, manholes, handholes and pull boxes, etc. Labels must be as specified herein.
- C. All wires and feeder cables must be labeled in all junction boxes pull boxes, control panels, motor control centers, panelboards, switchboards, etc. All conductors must be tagged in cabinets at the time wires are pulled in and tested and markers must not be removed for any reason.
- D. Markers approved by the Engineer, CDA, and FAA must be attached to all cables where entering or leaving from conduit runs. The cable designation and circuit use must appear on the tag.
- E. Apply colored, pressure sensitive tape in half-lapped turns for a distance of 2 inches from the cable marker and in all boxes. Provide color coding at all splices and taps to each side of the splice or tap. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not obliterate cable tag with the tape.
- F. All conduit runs must be identified by means of non-corrosive metal tag with stamped identification thereon, as shown on Contractor's installation

Drawings and attached at all conduit terminations, including junction boxes. For interior work a nylon tag, mechanically printed may be used in lieu of metal.

- G. Conduit identification tags must be fastened to the conduit near the point of termination where conduits enter motor control centers, switchboards, switchgear, terminal cabinets, outlet boxes, junction boxes, pull boxes and other items. The tag must be held in place by a nylon, self-locking cable tie.
- H. Conduits in miscellaneous pull boxes in runs where the system identity cannot be clearly seen must have identifying tags indicating the name of the system. Such tags must be installed as described above. Miscellaneous systems must include, but not be limited to, telephones, lighting, etc.
- I. Conduits terminating at lighting fixtures, wall switches, telephones, terminal cabinets, lighting panelboards, receptacle outlets and similar items need not be tagged where their system identification is obvious, except as noted above for clarity.
- J. Exterior installed conduits, except branch lighting circuit conduits, must be tagged at the ends and in intermediate boxes, chambers, manholes, handholes and other enclosures in accordance with the same inscriptions as shown on the Drawings.
- K. Tags must be fastened as specified except that where this method is not practicable they must be fastened to the adjacent masonry by means of expansion bolts.
- L. Phase identification letters must be 1 inch high in readily visible locations, and must be stamped into the main bus bars of switchboards and panelboards.
- M. For conduits in duct banks and embedded in structural slabs, etc. the conduit identification must be installed at the point where the conduit exits the slab.

25.03 OPERATIONAL IDENTIFICATION AND WARNING:

- A. Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.
- B. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated, either by the Contract Documents or as directed by the Engineer, CDA, and FAA,

and at locations subsequently identified by installer of electrical work as constituting similar dangers for persons in or about the facility.

1. Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
2. Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, damage to or loss of property.

25.04 EQUIPMENT/SYSTEM IDENTIFICATION:

- A. Install engraved plastic-laminate signs on each unit of electrical equipment; including central or master unit of each electrical system including communication/control/ signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering from the Contract Documents and Shop Drawings. Provide signs for each unit, but not limited to, the following categories of electrical work:
 1. Panelboards, electrical cabinets and enclosures.
 2. Access panel/doors to electrical facilities.
 3. Major electrical switchgear.
 4. Electrical substations.
 5. Motor control centers.
 6. Power transfer equipment.
 7. Transformers.
 8. Inverters.
 9. Disconnect Switches.
 10. Motor Starters.
 11. Time Clocks, Contactors, etc.
 12. Rectifiers.
 13. Frequency converters.
 14. Battery racks.
 15. Power generating units.
 16. Telephone switching equipment.
 17. Clock/program master equipment.
 18. Call system master station.

- 19. TV/audit monitoring master station.
 - 20. Fire alarm master station.
 - 21. Security monitoring master station.
 - B. Install signs at locations indicated or, where not otherwise indicated, at the location which provides the best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use a permanent adhesive where fasteners should not or cannot penetrate substrate.
 - C. Provide Identification on all pull, junction, splice or terminal boxes. Identification must consist of the voltage contained within the enclosure and the enclosure identification.
- PART 26 METHOD OF MEASUREMENT
- 26.01 MEASUREMENT
 - A. All work associated with this specification will not be measured separately for payment, but will be considered included in the overall Contract.
- PART 27 BASIS OF PAYMENT
- 27.01 PAYMENT
 - A. All costs associated with this section will not be paid for separately but are included in the overall Contract price. No additional time or monies will be granted to the Contractor for compliance with the requirements of this Section.

GROUNDING FOR FAA RELOCATIONS (SECTION 16452)

PART 28 GENERAL

28.01 SECTION INCLUDES:

- A. Work under this section is subject to the requirements of the Contract Documents. This section applies to building and general electrical grounding. Airfield lighting and FAA grounding must be in accordance with current FAA Advisory Circulars and FAA Standards.
- B. Furnish and install all electrical Grounding work, materials and accessories as shown on the Drawings and as specified herein, including but not limited to the following:
 - 1. Metal building frames

2. Electrical power systems
3. Ground electrodes
4. Counterpoise loops
5. Separately derived systems
6. Raceways
7. Service equipment
8. Enclosures
9. Equipment
10. Lighting standards
11. Landscape lighting
12. Signs

C. Install products and materials (furnished in other sections) as shown on the Drawings and as specified herein, including but not limited to the following:

1. Grounding Conductor (s)
2. Ground Electrodes
3. Counterpoise Loops
4. Grounding Wells

D. Requirements of this section apply to electrical grounding and bonding work specified elsewhere in these Specifications.

28.02 RELATED WORK:

A. As specified in the following special provisions:

8. BASIC ELECTRICAL REQUIREMENTS FOR FAA RELOCATIONS
(SECTION 16010)
9. BASIC MATERIALS AND METHODS FOR FAA RELOCATIONS
(SECTION 16100)
10. FIBER OPTIC CABLE AND EQUIPMENT FOR FAA RELOCATIONS
(SECTION 16125)
11. ELECTRICAL IDENTIFICATION FOR FAA RELOCATIONS (SECTION
16195)
12. GROUNDING FOR FAA RELOCATIONS (SECTION 16452)
13. MALSR ELECTRICAL (SECTION 16620)
14. ALSF-2 ELECTRICAL (SECTION 16630)

28.03 REFERENCES:

- A. See special provision Basic Electrical Requirements for FAA Relocations
(Section 16010), 1.03.

28.04 SUBMITTALS:

- A. See special provision Basic Electrical Requirements for FAA Relocations
(Section 16010), 1.04 B.

28.05 QUALITY CONTROL:

- A. See special provision Basic Electrical Requirements for FAA Relocations
(Section 16010), 1.05.

28.06 DELIVERY STORAGE AND HANDLING:

- A. See special provision Basic Electrical Requirements for FAA Relocations
(Section 16010), 1.06.

28.07 WARRANTIES AND GUARANTEES:

- A. See special provision Basic Electrical Requirements for FAA Relocations
(Section 16010), 1.07

28.08 EXTRA MATERIALS AND SPARE PARTS:

- A. None required.

28.09 SPECIAL REQUIREMENTS:

- A. Field Measurements - Before proceeding with the fabrication of the Work, the
Contractor must verify all dimensions and take such measurements as are
required for proper fabrication and erection of the Work.
 - B. Coordination - Coordinate Work of this Section with related Work
specified in the other divisions/sections of the Contract Documents.

PART 29 PRODUCTS

29.01 ACCEPTABLE MANUFACTURERS:

- A. Products of one of the following Manufacturers will be acceptable (for each type of product):
1. Adalet-PLM Div.; Scott Fetzer Co.
 2. Burndy Corporation
 3. Cadweld Div.; Erico Products Inc.
 4. Crouse-Hinds Div.; Cooper Industries
 5. Eagle Electric Mfg.. Co.
 6. Ideal Industries, Inc.
 7. Joslyn Corporation
 8. Okonite Company
 9. OZ Gedney Div. General Signal Corp.
 10. Thomas and Betts Corp.
 11. Harger

29.02 GROUNDING WELL COMPONENTS

- A. Well Pipe: 12 inches diameter by 24 inches long ground test box.
- B. Well Cover: Cast iron
- C. Acceptable manufacturers are Harger, East Coast Lighting Equipment, Antenna Systems and Solutions, and Neenah (7506-F).

29.03 MECHANICAL CONNECTORS

- A. Manufacturers:
1. Erico Inc.; Electrical Products Group
 2. ILSCO Corporation
 3. Crouse-Hinds Division; Cooper Industries
 4. Thomas & Betts, Electrical
 5. Burndy Corporation
 6. O-Z Gedney Co.
 7. Apache Grounding
 8. Adalet-PLM Div.
 9. Eagle Electric Manufacturing, Co.

10. Ideal Industries, Inc.
11. Joslyn Corporation
12. Okonite Co.
13. Harger

- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

29.04 EXOTHERMIC CONNECTORS

- A. Manufacturers:

1. Erico Inc.; Electrical Products Group
2. ILSCO Corporation
3. Crouse-Hinds Division; Cooper Industries
4. Thomas & Betts, Electrical
5. Burndy Corporation
6. O-Z Gedney Co.
7. Apache Grounding
8. Adalet-PLM Div.
9. Eagle Electric Manufacturing, Co.
10. Ideal Industries, Inc.
11. Joslyn Corporation
12. Okonite Co.
13. Harger

- B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

29.05 GROUNDING AND BONDING:

- A. Except as otherwise indicated, provide electrical grounding and bonding systems indicated, with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters and additional accessories needed for a complete installation. Where more than one (1) type component product meets indicated requirements, selection is installer's option.
- B. Unless otherwise indicated, provide electrical grounding conductors for grounding system connections per Section 16100 - Basic Materials and

Methods and which are sized according to the Chicago Electrical Code. In no case must bare conductors be installed in the earth.

- C. Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
- D. Ground Electrodes must be stainless steel, 3/4 inch dia. x 10 feet for a maximum resistance of 5 ohms.
 - 1. For single ground point installation if more than one rod is needed to achieve a maximum of 5 ohms, install additional rods not closer than 6' - 0" on center.
 - 2. For counterpoise grounding, no ground rod must exceed 10 ohm maximum resistance. The completed counterpoise system must have a maximum resistance of 2 ohms. If 2 ohms cannot be met, as installed, additional rods must be installed at a minimum of 6' - 0" spacing between rods until the 2 ohms is met.+.
 - 3. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, etc. as recommended by accessories manufacturers for type service indicated.
 - 4. Comply with AWS Code for procedures, appearance and quality of welds; and for methods used in correcting welding work. Provide welded connections where grounding conductors connect to underground grounding and plate electrodes.

PART 30 EXECUTION

30.01 EXAMINATION:

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify the Engineer, CDA, and FAA in writing of conditions detrimental to proper completion of Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer, CDA, and FAA.

30.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS:

- A. Install electrical grounding and bonding systems as indicated and specified and in accordance with manufacturer's instructions and applicable portions of Chicago Electrical Code, NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products comply with requirements. EXCEPTION: No ground connection to waterlines.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

- C. Connect grounding conductors to underground grounding electrodes, using mechanical connectors. All ground rods are to be accessible to allow for periodic testing. Provide suitable covers and/or handholes for this purpose.
- D. Ground the electrical service system neutral at the service entrance equipment to the grounding system.
- E. Ground each separately-derived system neutral to the grounding system.
- F. Connect together system neutral, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, wiring device ground connectors, light fixtures and plumbing systems.
- G. Install counterpoises which encircle the building and are connected to structural columns, as shown on the Drawings, and to each driven electrode. Each connection to the building must be made using the exo-thermic welding process.
- H. Terminate feeder and branch circuit insulated equipment grounding conductors to grounding lug, bus or bushing.
- I. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- J. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.
- K. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- L. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- M. All conduits must contain a ground wire.

30.03 FIELD QUALITY CONTROL:

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance testing. These tests must be witnessed by the Engineer, CDA, and FAA. Where tests show resistance-to-ground is over the required ohms, take appropriate action to reduce resistance to the required ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.

PART 31 METHOD OF MEASUREMENT

31.01 MEASUREMENT

- A. All work associated with this specification will not be measured separately for payment, but will be considered included in the overall Contract.

PART 32 BASIS OF PAYMENT

32.01 PAYMENT

- A. All costs associated with this section will not be paid for separately but are included in the overall Contract price. No additional time or monies will be granted to the Contractor for compliance with the requirements of this Section.

MALSR ELECTRICAL (SECTION 16620)

PART 33 DESCRIPTION

33.01 SECTION INCLUDES

- A. Work under this section is subject to the requirements of the Contract Documents.
- B. Furnish and install all electrical work associated with the proposed MALSR as shown on the Drawings and as specified herein. This work must include, but not be limited to the following:
 - 1. General Electrical Materials
 - 2. MALSR Light Fixtures and Lamps
 - 3. Power Distribution Equipment
 - 4. Grounding
 - 5. Conduit, Enclosures, and Wireways
 - 6. Wire and Cable
 - 7. Electrical Identification

33.02 RELATED WORK

- A. As specified in the following special provisions:
 - 1. MALSR Modifications and Foundations (Section 13100)

33.03 REFERENCES

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.03.
- B. See special provision FAA Specification Sections (Section 13650) for referenced FAA specification sections.

33.04 SUBMITTALS

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.04.
- B. The Contractor must submit with the wire shop drawing a listing of the code numbers used by the Manufacturer.

33.05 QUALITY ASSURANCE

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.05.

33.06 DELIVERY STORAGE AND HANDLING

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.06.

33.07 WARRANTIES AND GUARANTEES

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), part 1.07.

33.08 EXTRA MATERIALS AND SPARE PARTS

- A. None required.

33.09 ENVIRONMENTAL REQUIREMENTS

- A. None required

33.10 SPECIAL REQUIREMENTS

- A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.
- B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.
- C. See section 13650, Appendix section 16A.2.

PART 34 PRODUCTS

34.01 GENERAL

- A. All equipment furnished must conform to the requirements given herein.
- B. All assemblies must be acceptable agency labeled for the intended application.
- C. For electrical tape see section 13650, Appendix section 16A.21.
- D. For electrical coating around connections, splices, or other joints wrapped with electrical tape see section 13650, Appendix section 16A.25.

34.02 MALSR LIGHT FIXTURES AND LAMPS

- A. MALSR light fixtures must be installed as shown on the drawings, and in accordance with specification section 13650, Appendix section 13A.2.c.
- B. MALSR lamps must be installed as shown on the drawings, and in accordance with specification section 13650, Appendix section 13A.5. Also see modifications per section 13650, Appendix Supplement items #2 and #16.
- C. For direction on MALSR light fixture brightness, see specification section 13650, Appendix section 13A.3.

34.03 POWER DISTRIBUTION

- A. For panelboard circuit directories see section 13650, Appendix section 13A.7.
- B. For panelboard and circuit breaker materials and installation see section 13650, Appendix section 16A.14.

34.04 GROUNDING

- A. For grounding materials and installation see section 13650, Appendix section 16A.4 and table titled "Cadweld Exothermic Welding Kits" located at the end of section 16A. (Note Appendix sections 16A.4.a and 16A.4.b are also referenced in section 2.03 of this specification.) Also see modifications per section 13650, Appendix Supplement items #7, #8, #10, and #15.

34.05 CONDUIT, ENCLOSURES, AND WIREWAYS

- A. For conduit materials and installation see section 13650, Appendix section 16A.3.
- B. For enclosure and wireways materials and installation see section 13650, Appendix section 16A.15.
- C. For expansion coupling materials and installation see section 13650, Appendix section 16A.27.

34.06 WIRE AND CABLE

- A. For MALSR cable splices see section 13650, Appendix section 13A.6.

- B. For protection of exterior cables during installation see section 13650, Appendix section 16A.8.
- C. For control cable terminal strip materials and installation see section 13650, Appendix section 16A.19.
- D. For pre-stretched rubber tubing (waterproof seal of cables) materials and installation see section 13650, Appendix section 16A.19.
- E. For cable connection protection materials see section 13650, Appendix section 16A.24.
- F. For power cable material between the existing external distribution panel and the MALSR and antenna array see section 13650, Appendix section 16B.

34.07 ELECTRICAL IDENTIFICATION

- A. For electrical identification materials and installation see section 13650, Appendix section 16A.10.

PART 35 EXECUTION

35.01 GENERAL

- A. Installation of all materials is as noted in the associated Appendix section referenced above.
- B. The newly installed MALSR assembly must be operationally tested in accordance with section 13650, Appendix section 13A.4.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

- A. No separate measurements will be made for this item. This work will be included in the pay items in special provision MALSR Modifications and Foundations (Section 13100).

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

- A. No separate payment will be made for this item. This work will be included in the pay items in special provision MALSR Modifications and Foundations (Section 13100).

ALSF-2 ELECTRICAL (SECTION 16630)

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish and install all work associated with the proposed ALSF-2 modifications as shown on the Drawings and as specified herein. This work must include, but not be limited to the following:
1. Installation of new base cans and conduits to feed proposed ALSF-2 station
 2. Installation of new temporary ALSF-2 tower, foundation, and light fixtures
 3. Removal and disposal of existing conductors connecting through existing ALSF-2 station
 4. Installation of new conductors connecting through new temporary ALSF-2 station
 5. Removal of existing ALSF-2 tower, foundation, and associated conduits and ductbank
 6. Re-installation of existing ALSF-2 tower with new foundation and associated conduits at new location
 7. Disconnection and pulling back of new conductors connecting through temporary ALSF-2 station, and re-connection through relocated, permanent ALSF-2 station.
 8. Removal and storage of temporary ALSF-2 tower, and removal and disposal of associated foundation and conduits.
 9. Installation of new lamps, cabling, and transformers for relocated ALSF-2 tower.
 10. The Contractor must furnish all additional materials, labor, testing, certification and equipment to perform these items of work to the satisfaction of the Engineer, CDA, and FAA..
 11. Site preparation and site restoration in the areas where ALSF-2 system modifications are made.

1.02 EQUIPMENT

- A. The following equipment required for the dual mode ALSF-2 approach lighting system will be purchased by the Contractor. The ALSF-2 parts for the light towers to be installed are as manufactured by New Bedford Panoramex, Inc. and include:

1. 1 Junction Box P/N 3001011-01
 2. 1 Individual Control Cabinet (ICC) P/N U3001008-01
 3. 1 light flasher Assembly P/N U3001009-01
 4. 5 Elevated PAR-56 Lamp Holders P/N U3001010-01
 5. 5 Transceivers / Shorting Devices P/N U3001080-01
 6. One (1) Aiming Device P/N U3001007-01
 7. One (1) Flasher Tester P/N U3001016-01
 8. One (1) Installation Kit
 9. Two (2) TI Manuals P/N/TI 6850.87
- B. The Contractor must furnish and install the remaining equipment and components required to complete the ALSF-2 system including but not limited to the following:
1. LIR Structures – Jaquith Industries, Inc.
600 Brighton Avenue
Syracuse, NY 13210-4213
315-478-5700
www.jaquith.com
 2. PAR-56 Lamps (Including Spares):
10 – 300W, 20A lamps with NO colored glass filters
 3. L-830 Isolation Transformers:

2 – 1500W 20A/20A Isolation Transformers
 4. All other electrical equipment shown on the drawings and specified herein.
 5. Winch Bracket

1.03 INCLUDED WORK

- A. All sections of these technical special provisions for FAA relocations apply

PART 2 PRODUCTS

2.01 Dual Mode ALSF-2/SSALR Approach Lighting System

- A. The existing dual mode ALSF-2/SSALR system is FAA approved Type FA-10700, with all the latest updates as manufactured by New Bedford Panoramex, 1037 West Ninth Street, Upland, CA 91786, Telephone 909-982-9806.
- B. The 300-watt and 500-watt isolation transformers must be type L-830 per

FAA AC 150/5345-47B.

- C. The 1500-watt isolation transformers must be as specified in Specification Section L-892.
- 2.02 Steady Burning Light Fixtures are classified as follows:
Style A White Light
- 2.03 BASES
- A. Light Bases must conform to the requirements of AC 150/5345-42F, "Specification for Airport Light Bases, Transformer Houses, Junction Boxes, and Accessories", and they must be Class IB, stainless steel 16-inch diameter, Type L-867 base as shown on the Plans and must be listed in FAA AC 150/5345-53C. All light bases must be provided with factory installed internal and external ground lugs.
 - B. The light bases installed for the new tower bases must be L-867, size D, 28" deep, type 1.
- 2.04 REINFORCED CONCRETE
- A. Concrete required for the construction of bases and other work under this item must conform to the requirements of Section P-610, using ¾-inch maximum size aggregate.
 - B. Reinforcing bars required for the construction of the bases, foundations and other work under this item must conform to the requirements of Section P-610.
- 2.05 GROUND RODS
- A. Ground rods must be type 304, stainless steel, of the length and diameter shown on the Plans.
- 2.06 Conduit. All conduits for duct banks must be in accordance with Section L-110 of these specifications.
- 2.07 Pull Boxes. All pull boxes must be in accordance with Section L-115 of these specifications.
- 2.08 Cable. All cable must be in accordance with Sections L-105, L-108, and 16130 of these specifications.
- 2.09 Guard Wire. All guard wire must be in accordance with Sections L-108 and 16452 of these specifications.

PART 3 EXECUTION

3.01 INSTALLATION OF ALSF-2 LIGHT BARS AND SEQUENCED FLASHERS

- A. The Contractor must follow the procedures contained herein in installing the

elevated ALSF-2 light bars and sequenced flashers. The Contractor must provide all materials not specifically listed in the Contract as provided to him/her.

- B. In order to optimize conduit and ductbank construction, the Contractor may find it advantageous to modify the horizontal layout of some LIR tower foundations, flasher junction boxes, and flasher individual control cabinets (ICC's). This may involve re-orienting the flasher junction box and ICC location, foundation layout, or fencing layout. Such modification must not involve a change in the ALSF-2 Station of a tower or LIR tower tilt-down direction shown on the plans, or encumber the raising or lowering of a tower. The Contractor must not execute any deviation from the light bar site configuration shown on the drawings without first receiving the approval of the Engineer, CDA, and FAA.
- C. Installation Tolerances. Lamps must be installed with their centerlines within the following installation tolerances of design distances:
- | | |
|---|----------|
| 1. Longitudinal (along the runway centerline) distance deviation from design station: | 6 inches |
| 2. Lateral distance (perpendicular to the runway centerline): | 3 inches |
| 3. Horizontal distance between individual lights | 1 inch |
| 4. Lamp centerline elevation: | |
| a. On structures up to 6 feet above foundation top | 1 inch |
| b. On structures more than 6 feet above foundation top | 2 inches |
| 5. All lights in a light bar must be installed within 1 inch of a line perpendicular to runway extended centerline. | |
- D. Assembly of PAR-56 Lights. The Contractor must assemble from unassembled condition into complete units, the PAR-56 lampholders, transceiver/shorting devices, lamps, and, where required, filter-holding clips and colored glass filters. Use the spring-loaded lamp-retaining hardware supplied with the lampholders. This assembly must include the NBP PAR-56 lampholder ring where the drawings require it.
- E. Frangible Couplings. All frangible couplings must be 2"-diameter cast aluminum couplings having a hexagonal clamping ring. The coupling must accommodate 2"-diameter EMT conduit. The frangible couplings must meet the requirements of either Military Specification MS-17814-1, or of FAA Drawing C-6046. The straight-thread Multi-Electric Cat. No. 961-A frangible coupling is among couplings meeting MS-17814-1. The tapered-thread Multi-Electric Cat. No. 961-AT frangible coupling is among couplings conforming to

FAA Drawing C-6046. If the Contractor intends to furnish substitute frangible couplings, the Contractor must submit catalog cuts to the Engineer, CDA, and FAA, demonstrating that the substitute couplings meet the above specifications. The Contractor must furnish 40 spare frangible couplings to the Engineer, CDA, and FAA, who will deliver them to the FAA.

- F. Fiberglass LIR Approach Lighting Towers. LIR means Low Impact Resistance. An LIR tower is a tower designed to disintegrate when struck by an aircraft, offering low impact resistance to the aircraft, thus minimizing aircraft damage. The fiberglass LIR towers must be assembled from knocked-down (unassembled) condition according to the manufacturer's assembly instructions. Install the towers on foundations constructed in accordance with the drawings.
- G. Aiming and Alignment of Lights. Each light must be adjusted so that its optical axis is parallel to the runway centerline, directed outward from the runway threshold, and aimed upward to the required vertical angle. An aiming device is furnished for vertical aiming of the PAR-56 lampholders and flashing light units.
- H. All ALSF light bar/tower foundations must be cast-in-place.

3.02 FLIGHT TEST.

- A. The Contractor must coordinate with the Engineer, CDA, and FAA and the FAA to schedule the FAA flight check.
- B. The Contractor must coordinate with the Engineer, CDA, and FAA and the FAA to obtain a copy of the results of the flight check. In the event that the flight check results are unsatisfactory, the Contractor must make any corrections or adjustments to the ALSF-2 construction as required to pass the flight check, at no additional cost to the Contract.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

- A. Payment for ALSF-2 Light Tower will be made per each temporary or relocated light base with all labor, materials, equipment, tools, and any additional items necessary to complete this item in accordance with the Drawings and the specifications.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

- A. Payment for ALSF-2 Light Tower will be made per each temporary or relocated light base with all labor, materials, equipment, tools, and any additional items necessary to complete this item in accordance with the Drawings and the specifications.
 - 1. INSTALL TEMPORARY ALSF-2 MG-20 LIGHT TOWER – COMPLETE, per each.
 - 2. RELOCATE ALSF-2 MG-20 LIGHT TOWER – COMPLETE, per each.
 - 3. ADJUST WINCH BRACKET ON ALSF-2 TOWER – COMPLETE, per each.

TESTING FOR FAA RELOCATIONS (SECTION 16950)

PART 36 GENERAL

36.01 SECTION INCLUDES:

- A. Work under this section is subject to the requirements of the Contract Documents.
- B. Furnish and provide all work, materials, instruments and accessories necessary to provide, but is not limited to, the following:
 - 1. Testing of electrical systems.
- C. Refer to Specification 16125 for testing of fiber optic cables.
 - (b)

36.02 RELATED WORK:

- A. As specified in the special provisions for FAA relocations.

36.03 REFERENCES:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.03.

36.04 SUBMITTALS:

- A. The Contractor must submit data to the Engineer, CDA, and FAA prior to purchasing and installation. The data must include but not be limited to the following:
 - 1. All test reports as witnessed and signed by the Engineer, CDA, and FAA.

2. All certified test reports as specified elsewhere.

36.05 QUALITY CONTROL:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.05.

36.06 DELIVERY STORAGE AND HANDLING:

- A. See special provision Basic Electrical Requirements for FAA Relocations (Section 16010), 1.06.

36.07 WARRANTIES AND GUARANTEES:

- A. None required.

36.08 EXTRA MATERIALS AND SPARE PARTS:

- A. None required.

36.09 ENVIRONMENTAL REQUIREMENTS:

- A. None required.

36.10 SPECIAL REQUIREMENTS:

- A. None required.

PART 37 PRODUCTS

37.01 TESTING:

- A. The following tests are required, but must not be limited to, this list. All tests will be witnessed by the Engineer, CDA, and FAA.
 1. Proper phase rotation.
 2. Short circuits.
 3. Improper grounds.
 4. Power and control electrical circuits for circuit continuity and functional tests.
 5. Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems must be in accordance with NETA ATS.
- B. The Contractor must furnish all meters, instruments, cable/wire connections, etc. for all tests.
- C. The Contractor must check all transformers, power panels, feeders, power and control cables and connections and motors to assure correct phase sequence and rotation. Phase sequence must be A-B-C as follows:
 1. Top to bottom, left to right, and front to rear when facing protective or disconnecting mechanism.

2. Phasing must be done using distinctive colors for the various phases as indicated in the Contract Documents.
- D. After wires and cables are in place and connected to devices and equipment, the system must be tested for short circuits, improper grounds and other faults. If a fault condition occurs the trouble must be corrected and the system must be retested.
- E. Phase conductors, if shorted, grounded or at fault must be replaced and retested.
- F. A voltage test must be made at each lighting panel, distribution panel, receptacle panel and at the last power consuming device in the circuit to check the voltage drop. This test must be done under the full load of the circuit being tested. For receptacles there must be a load of 1200 watts applied to the last outlet and the voltage drop must be tested at this point. If a voltage drop exceeds 1 percent for lighting and 3 percent for power the Contractor must correct the condition by locating the high resistance splice or connection and must then retest the system.
- G. Any wiring device, electrical apparatus or lighting fixture grounded or shorted on any "live" part must be removed and the trouble rectified by replacing the defective parts or materials.
- H. Upon completion of the electrical work the Contractor must place the entire installation in operation, test for proper function and show systems and equipment to be free from all defects. Motors and driven equipment must not run until properly lubricated. Pumps must not be run until water or process fluid supply is connected and turned on. Test and record maximum load amperage and terminal voltage when coupled and uncoupled for each motor.
- I. The Engineer, CDA, and FAA will conduct from time to time such tests as may be required to any part of the equipment to determine if it is installed in accordance with the Contract Documents. The Contractor will extend to the Engineer, CDA, and FAA all facilities to this end and must furnish skilled or unskilled help required. All tests will be witnessed by the Engineer, CDA, and FAA and three copies of the verified test report must be given to the Engineer, CDA, and FAA promptly upon completion of the test.
- J. The Contractor must provide assistance to the various equipment manufacturer's field personnel as required in the testing and adjusting of the electrical power and control equipment. Cooperation of the Contractor must be such that a minimum of time is required for equipment testing.
- K. A log must be maintained by the Contractor of all tests. This log must be certified before completion of the job, both as to test values and date of test. All major equipment such as switchgear, motor control centers and motors must be initially energized in the presence of the Engineer, CDA, and FAA.

- L. Any faults in the work performed by the Contractor or in materials or equipment furnished by the Contractor must be corrected or replaced promptly by the Contractor at his/her own expense. Any faults in materials or equipment furnished by the Contractor which are the result of careless, incompetent or improper handling or installation by the Contractor must be corrected or replaced, as directed by the Engineer, CDA, and FAA, at the Contractors expense.
 - M. All tests must be made by the Contractor at the Contractors' expense and certification of the tests will be submitted to the Engineer, CDA, and FAA. If any failures occur during the tests the Contractor must replace the faulty equipment of materials and retest.
- 37.02 WIRE AND CABLE TESTING (600 VOLTS):
- A. The 600 volt insulated wire and cables must be factory tested prior to shipping in accordance with IECA Standards for the insulation specified.
 - B. The following 600 volt wires and cables must be tested after installation but before final connections are made up:
 - 1. All feeders from 480 volt switchgear or unit substations.
 - 2. All feeders from 480 volt switchboards.
 - 3. All feeders from 480 volt distribution panels.
 - 4. All feeders from 480 volt motor control centers.
 - 5. All feeders to panelboards.
 - 6. All conductors #6 and larger.
 - C. For the above listed wires and cables the Contractor must megger test them at 1000 volts. The minimum acceptable reading must be 250 Megohms. The megger test must not be done until any and all splicing is completed.

PART 38 EXECUTION

38.01 TEST EQUIPMENT:

- A. All test equipment must be in good operating condition and must have been calibrated within 6 months of date of usage. At the time of testing the Contractor must present a copy of the certification of calibration to the Engineer, CDA, and FAA.
- B. All tests must be done with the proper equipment for the type of test being performed. When necessary the Contractor must obtain the services of a testing company to perform those tests which the Contractor either does not have trained personnel or proper testing equipment.
- C. All megger tests must be recorded on Form 16950. When an outside testing company is used the test report form will be submitted to the Engineer, CDA, and FAA for review and acceptance.

- D. All test reports must be signed and dated.
- PART 39 METHOD OF MEASUREMENT
- 39.01 MEASUREMENT
- A. All work associated with this specification will not be measured separately for payment, but will be considered included in the overall Contract.
- PART 40 BASIS OF PAYMENT
- 40.01 PAYMENT
- A. All costs associated with this section will not be paid for separately but are included in the overall Contract price. No additional time or monies will be granted to the Contractor for compliance with the requirements of this Section.

FORM 16950

SINGLE AND MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600V AND LESS WIRING-FEEDER CIRCUITS

Testing must be performed before connecting the cables to the terminals at either end. Continuity of each conductor must be checked at this time.

Each conductor must be checked with a 1000 volt megger to ground, with all other conductors in the cable and shield, grounded. The minimum acceptable resistance will be 250 megohms for each conductor to ground.

Date:	_____	Project Name:	_____
Feeder Number:	_____	Location:	_____
From:	_____	To:	_____
Cable Size:	_____	Cable Length:	_____
Number of Conductors:	_____	Insulation Type:	_____
Manufacturer:	_____	Line Voltage:	_____
Temperature:	_____	Humidity:	_____
Megger Type:	_____	Serial Number:	_____
Test Voltage:	_____	Date of Calibration:	_____

Remarks: _____

If Applicable, All Shields Must Be Properly Grounded.

Cable No.	MEGOHMS Phase A	MEGOHMS Phase B	MEGOHMS Phase C	MEGOHMS Neutral

Test Performed By: _____
 Signature/Name/Company Date

Test Witnessed By: _____
 Signature/Name/Company Date

INSTALLATION OF FAA SIGNAL CABLE SECTION L-105)

PART 41 GENERAL

41.01 DESCRIPTION

- A. The work will consist of furnishing and installing of signal cable for FAA owned ALSF-2 equipment. This item will include the modification of the FAA Facility communication system and termination equipment and materials, cable marking, testing of cables for acceptability, and any other items incidental to the communication system and cable installation.:
- B. Cable covered under this item includes the entire cable length through the building interior conduit system to the point of cable termination. This Item does not include trenching, installation of conduit and ducts, installation of concrete manholes or handholes, backfilling and area restoration.

41.02 RELATED DOCUMENTS

- A. The general provisions of the contract, including general and special conditions and compensations conditions, apply to work specified in this item.
- B. Special provision FAA Specification Sections (Section 13650)
- C. Special provision Basic Materials and Methods for FAA Relocations (Section 16100)
- D. Special provision Installation of Underground Cable for Airports (Section L-108)

41.03 SPECIFICATIONS AND STANDARDS

- A. As a supplement to the installation requirements of this item, the following standard specifications and regulations of the issues in effect of the date this solicitation are incorporated herein by reference and are made a part hereof for electrical work and installation and splicing of underground cables.
 - 1. NEC – National Electric Code
 - 2. FAA-STD-019e – Lighting Protection, Grounding, Bonding and Shielding Requirements for Facilities
 - 3. FAA-C-1217f – Electrical Work, Interior
 - 4. City of Chicago Electrical Code (CEC)

41.04 SHOP DRAWINGS AND MATERIAL LISTS

- A. Prior to the installation of any material and equipment and within 30 days of the contract award, the Contractor must submit to the Director for approval eight (8) copies of manufactures' brochures. These brochures must contain complete dimensional and performance characteristics, wiring diagrams, installation and operation instructions, etc., for the signal cables and all related connectors and accessories.
- B. In addition to the above specific item, a materials list must be submitted listing each specification paragraph number.

PART 42 PRODUCTS

42.01 SIGNAL CABLE

- A. Outdoor underground signal cable used for localizer, ALSF-2, PAPI, and RVR must be #19 AWG solid conductor, twisted-pair, filled telephone cable with overall shield per REA Specification PE-89 in REA bulletin #345-89.

42.02 PULLING COMPOUND

- A. A non-hardening lubricant recommended for use with the type of cable installed, must be used during pulls.

PART 43 EXECUTION

43.01 GENERAL

- A. The Contractor must install the specified cable at the locations indicated in the electrical layout plans and facility site plans. This Item includes the underground installation of all FAA signal cable. The Contractor must provide all materials. Cable pulling tensions must not exceed the manufacturer's requirements and continuous tape readout from pulling winch strain gauge must be provided and noted for the Director to review at the completion of the project.

43.02 INSTALLATION IN DUCT OR CONDUIT

- A. This item includes the installation of cable in conduit as described below. Connections or joints of any kind will not be permitted in cables installed in conduit.
- B. The duct or conduit is existing or must be installed as a separate item in accordance with Item L-110, "Installation of Airport Underground Electrical Duct." The Contractor must make sure that the duct is open, continuous, and clear of debris before installing cable. The cable must be installed in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering. The ends of all cables must be sealed with moisture-seal tape before pulling into the conduit and must be left sealed until connections are made. Where more than one cable is to be installed in a duct under the same contract, all cable must be pulled into the conduit at the same time. The pulling of a cable through ducts or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Pulling tensions should be governed by recommended standard practices for straight pulls or bends. A lubricant recommended for the type of cable being installed must be used where pulling lubricant is required.

43.03 CABLE IDENTIFICATION

- A. All multipair cables must be identified at every handhole, manhole, and termination cabinet by use of engraved or stamped plastic or nonferrous metallic tags. Tags must be secured to the cables by use of plastic tie wraps. Tags must identify system (i. e., power, control, fiber optic) and destination or circuit (i. e., LOC, G/S, etc.). Cable tags must resist fading over time. Tags must be installed on both entry and exit of every manhole and handhole.

43.04 INSTALLATION OF CABLES

- A. The Contractor must provide a plan scheduling cable pulling for the approval of the FAA and the Director prior to installing any of the cable. When cable cutting is required, cable ends must be effectively sealed against moisture immediately after cutting. The Director

will approve the method of sealing. Bends of a radius less than the manufacturers' recommended minimum bending radius will not be permitted. Pulling cable into the duct by dragging over the ground will not be permitted.

43.05 CABLE TESTING.

A. General Requirements.

1. Both before and after installation, all power cables and signal cables (control cables, telephone cables), any segment of which is underground, must be tested as required herein. Testing after installation must be accomplished across splices.
2. All testing must be accomplished in the presence of the Director. Furnish two signed and dated copies of all test results, clearly tabulated for all segments of cable tested, to the Director.
3. The Contractor must use his/her own test equipment, which must bear current calibration certification from a certified instrument calibration laboratory.
4. Any measured values not conforming to specified values will be cause for rejection of the defective cable installation. After repair or replacement, if so required by the Director, the cable must be retested and additional remedial work performed until satisfactory test results are obtained. All repair and replacement work must be accomplished without added expense to the Contract.

B. Signal Cable. Any signal cable not meeting all the following requirements will be rejected.

1. Conductor continuity must test positive.
2. Shield continuity must test positive.
3. Dielectric strength/insulation resistance must test at least 50 megohms minimum at 500 volts D.C. between paired conductors and between individual conductors and grounded shield.
4. Installed signal cable must comply with the following:
 - a. For 11 pair or less cable, all pairs must test acceptable.
 - b. For 12 to 25 pair cable, all pairs or all pairs except one must test acceptable.

43.06 SIGNAL CABLE TERMINATION.

A. Scope.

1. ALSF-2 Flasher #19 AWG Control Cable. The Contractor must terminate only those conductors that the drawings show terminated, and must ground the unused conductors as specified in Paragraph 3.07 below.

B. Cable Pair Bundling and Routing. Exposed cable conductor pair bundles must be lock-stitched laced together with nylon lacing twine spaced at approximate 5/8-inch intervals. Each bundle must contain a maximum of 25 pairs of conductors, which must be neatly routed and secured to backing panels with nylon clamps.

C. Cable Pair Terminations.

1. Terminated pairs must have the same sequence on each terminal strip. (For terminal block specifications, see Paragraph 2.03D of Section 16131.) The color code termination sequence on the terminal strips must be in accordance with the following schedule. The white mates must start at the top or left-hand side of the terminal block with color continuing down or across the block according to the following schedule:

<u>MATE COLORS</u>	<u>PRIMARY WIRE COLORS</u>
WHITE	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
RED	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
BLACK	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
YELLOW	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE
VIOLET	BLUE
"	ORANGE
"	GREEN
"	BROWN
"	SLATE

2. When cables do not have the preceding color code, like pairs must be terminated in the same sequence at both ends of the cable.

43.07 GROUNDING SIGNAL CABLE SHIELD AND UNUSED CONDUCTORS.

A. Grounding Locations.

1. Signal cable shields and unused conductors must be grounded at each end of each cable run, except where otherwise specified in the cable shield grounding schedule of the ALSF-2 system interconnect schematic diagram drawing.
2. Signal cable shield must not be grounded at splices.

B. Grounding Procedures.

1. Use #14 AWG stranded copper grounding conductors for grounding cable overall shields. Secure grounding conductors to shield by using UL-approved grounding

connectors specifically designed for this purpose. Neatly tape over the connection with electrical tape.

2. Strip the unused conductors, insert them, plus a #14 AWG grounding conductor, into a properly-sized butt splice, crimp them, and attach the #14 AWG grounding conductor to the enclosure interior wall with a machine screw and nut.
3. Insert the drain wires of all terminated pairs having a drain wires, plus a #14 AWG grounding conductor, into a properly-sized butt splice, crimp them, and attach the #14 AWG grounding conductor to the enclosure interior wall with a machine screw and nut.

PART 44 METHOD OF MEASUREMENT

44.01 MEASUREMENT

- A. Twisted shielded signal cable will be measured by the number of lineal feet measured in place, completed, tested, ready for operation, and accepted as satisfactory .

PART 45 BASIS OF PAYMENT

45.01 PAYMENTS

- A. Payment will be made at the Contract unit price per foot for signal cable installed by the Contractor and accepted by the Engineer, CDA, and FAA. This price includes full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and all work necessary to complete this item.

1. ALSF-2 FLASHER CONTROL CABLE, 12 PAIR #19, SHIELDED, per foot.

INSTALLATION OF UNDERGROUND CABLE FOR AIRPORTS (SECTION L-108)

PART 46 DESCRIPTION

46.01 GENERAL

- A. The work consists of furnishing and installing underground cable in accordance with these Specifications at the locations shown in the Drawings. This item includes the installation of airfield lighting and power cables, airfield lighting equipment grounding cable, airfield lighting counterpoise wire, and FAA guard wire. It includes cable connections, splicing, tagging, cable marking, and testing of the installation and all work necessary to place the cable in operating condition as a completed unit to the satisfaction of the Engineer, CDA, and FAA. This item also includes removal of existing wire and cable as shown on the Drawings and providing temporary and permanent wiring to keep existing circuits in service during construction. This item does not include the installation of the duct or conduit. The work under this Section is subject to the requirements of the Contract Documents.

46.02 REFERENCES

- A. Special provision Installation of Airport Underground Cable for Airports (Section L-110), part 3.02 B – Tracing FAA Ductbank Containing FAA Fiber
- B. Refer to special provision Basic Materials and Methods for FAA Relocations (Section 16100), par 1.03 through 1.10 for additional requirements

PART 47 EQUIPMENT AND MATERIALS

47.01 GENERAL

- A. Airport underground cables covered by Federal Aviation Administration (FAA) Specifications must have the prior approval of the FAA, and are described in Advisory Circular (AC) 150/5345-7 (latest revision), "Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits" and must be listed in the latest issue of FAA Advisory Circular (AC) 150/5345-53 "Airport Lighting Equipment Certification Program", Appendix 3 and 4 Addendum.
- B. All other equipment and materials covered by other referenced Specifications will be subject to acceptance through manufacturer's certification of compliance with the applicable Specification, when requested by the Engineer, CDA, and FAA.
- C. All materials and equipment used to construct this item must be submitted to the Engineer, CDA, and FAA for approval prior to ordering the materials and equipment. Submittals consisting of marked catalog sheets or shop drawings must be provided. Submittal data must be presented in a clear, precise, and thorough manner. Manufacturer's certifications will not relieve the Contractor of his responsibility to provide materials in accordance with these Specifications and acceptable to the Engineer, CDA, and FAA. Materials supplied and/or installed that do not materially comply with these Specifications must be removed, when directed by the Engineer, CDA, and FAA, and replaced with materials that comply with these Specifications, at the sole cost of the Contractor.
- D. All equipment and materials furnished and installed under this Section must be guaranteed against defects in materials and workmanship for a period of at least 12 months from final acceptance by the Engineer, CDA, and FAA. The defective materials and/or equipment must be repaired or replaced, at the Engineer, CDA, and FAA's discretion, with no additional cost to the Contract. The Contractor must be responsible to maintain the required insulation resistance with isolation transformers connected in new circuits and new segments of existing circuits through the end of the Contract warranty period.

47.02 SERIES AIRFIELD LIGHTING CABLE, COUNTERPOISE, GUARD WIRE, AND GROUNDING CONDUCTORS

- A. FAA approach lighting system series lighting cables must be 5,000 volt (5KV) cross-linked polyethylene insulated and must conform to the requirements of AC 150/5345-7 (latest revision), L-824 Type C, 5KV, size 6 AWG copper, 7 strand, single conductor cable and as indicated in the Contract Drawings. Cables must have a conductor stress relief shield, in accordance with Section 3 of the Insulated Cable Engineers Association Inc, ICEA S-96-659/NEMA WC71 as referenced in AC 150/5345-7 (latest revision).

Acceptable manufacturer of this type of cable are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum.

- B. All CED electrical ductbanks must be provided with lightning protection, either with counterpoise conductor or guard wire conductor, depending on the cables installed in the ductbank. Ductbanks containing FAA cables must be provided with guard wire, all other ductbanks must be provided with counterpoise only.
- C. Airfield lighting counterpoise conductors installed underground must be soft drawn bare copper, size 6 AWG, solid, and must conform to the requirements of AC 150/5340-30 (latest revision), Chapter 12, Equipment and Material. Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum.
- D. FAA airfield guard wire conductors installed underground must be soft drawn bare copper, 1/0 AWG, stranded, and must conform to the requirements of FAA standard-019e, Section 4.2.1.5 Equipment and Material. Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum.
- E. Equipment grounding conductors installed within airfield lighting bases/ fixtures, grounding conductors installed underground in conduit or ductbank must be soft drawn copper, size 6 AWG, 7 strand, with a 45 mil minimum coating of Type XHHW green insulation for airfield lighting and shall conform to the requirements of AC 150/5340-30 (latest revision), Chapter 12, Equipment and Material. Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum.
- F. Equipment grounding conductors installed within manholes must be soft drawn copper, utilizing a grounding bus of 4/0 AWG bare stranded copper and size 2 AWG pigtails bare copper to bond all metal hardware within the structure. The equipment grounding conductor must be bonded to ¾" diameter, 10'-0" long stainless steel ground rod installed in each manhole. The Equipment Grounding System must conform to the requirements of AC 150/5370-10 (latest revision). Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum. Ground bus, ground pigtails, and ground rods are included in the unit price of the L-115 electrical manhole pay items.
- G. Equipment grounding conductors installed within handholes must be soft drawn copper, utilizing a ground bus of 4/0 AWG stranded copper with 45 mil minimum coating of Type XHHW green insulation and size 2 AWG pigtails with a 45 mil minimum coating of Type XHHW green insulation to bond all metal hardware within the structure. The equipment grounding conductor must be bonded to ¾" diameter, 10'-0" long stainless steel ground rod installed in each handhole. The Equipment Grounding System must conform to the

requirements of AC 150/5370-10 (latest revision). Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum. Ground bus, ground pigtails, and ground rods are included in the unit price of the L-115 electrical handhole pay items.

- H. Samples and reports on the results of shop tests for all wire and cables and descriptive literature for cable connectors, splices and terminations must be submitted for review by the Engineer, CDA, and FAA prior to installation.
- I. The following wires and cables must be tested after installation but before final connections are made up: Service feeders, distribution feeders, branch circuit wiring and control wiring.

47.03 GROUND RODS

- A. Ground rods must be Type 304 solid stainless steel, ¾" diameter x 10'-0" long.

47.04 CABLE CONNECTIONS

- A. Cable connectors for series airfield lighting cables must be factory-molded or field attached plug-in connectors in accordance with the following. When the Plans or the proposal permit a choice of connection, the Contractor must indicate in the bid the type of connection that will be furnished.
 - 1. The Field-Attached Plug-in Splice: Figure 3 of AC 150/5345-26 (latest revision), "Specification for L-823 Plug and Receptacle, Cable Connectors," employing connector kits, is approved for field attachment to single conductor cables.
 - 2. The Factory-Molded Plug-in Splice: Specification for L-823 Connectors, Factory-Molded to individual conductors, is approved.
- B. Series circuit cable connectors for the connection of two single conductor wires to the secondary connector on the airfield lighting isolation transformer leads must be in accordance with FAA Specification L-823, Figure 2, of AC 150/5345-26 (latest revision).
- C. For CDA power circuit (non-airfield lighting 5 KV) cables at 600V – 7500V, splices and terminations must be made with compression type connectors and lugs that are U.L. listed and per the NEC. All lugs and connectors must be of the smooth conformable compression type suitable for use on 5 KV. Lugs must be two-hole, color-keyed for medium voltage requirements. Lug equipment and tools must be per the lug manufacturer's recommendations. All airfield splices must conform to appropriate FAA Advisory Circulars.
- D. For CDA power circuit cables at 0 - 600V, splices and terminations must be made with compression type connectors and lugs. Lugs must be 2 hole, color keyed. Lug bolting must include a flat washer, a Belleville washer, and a locknut. The lug manufacturer's recommended tools must be used. Indenter type compression fittings are not acceptable. All airfield splices must conform to appropriate FAA Advisory Circulars.
- E. Provide FAA approved electrical tape (Scotch Electrical Tape No. 88, 1 ½" wide; and Scotch 130C, 2" wide, as manufactured by Minnesota Mining and Company, or

approved equivalent) and 16" of approved heat shrink tubing over all primary cable splices in manholes, handholes and all light bases.

- F. Acceptable manufacturers of cable connectors are Amerace Ltd., Crouse-Hinds Molded products and Integro, LCC, and other manufacturers approved by FAA and listed in the current revision of FAA AC 150/5345-53C, Appendix 3.

47.05 SHRINKABLE CABLE CONNECTOR KITS

- A. Heat shrink tubing is to be designated for FAA Type L-823 plug and receptacle cable connectors. The heat shrink tubing is to be thick wall polyolefin, 16" full length, with a minimum shrink ratio of 3:1, designed for use with a heat gun or propane torch, and suitable for indoor or outdoor applications. Taping of connectors will not be permitted in lieu of heat shrink tubing. Connectors must be taped with a few turns of FAA approved vinyl tape prior to the installation of heat shrink tubing. Heat shrink tubing kits are to be installed in manholes, handholes and light bases. The secondary L-823 connectors from isolation transformers to airfield lighting/signage matching connectors must not have heat shrink tubing applied. These connectors are designed to be secured to the fixture and sign cover plates to provide an electrical disconnect at the frangible connector location, by break away action of the L-823 connectors.

PART 48 CONSTRUCTION METHODS

48.01 GENERAL

- A. The Contractor must install the specified cable at the approximate locations indicated in the Drawings.
- B. The work performed under this Section of these Specifications must conform to the requirements of the Chicago Electrical Code and the National Electric Code. The electrical systems must be complete with all necessary accessories to make them fully operational with the greatest assurance of protection to life and property.
- C. The Plans indicate the extent and general arrangement of the electrical work. If any departures from the Plans are deemed necessary by the Contractor, details of such departures and the reasons therefore must be submitted in writing as soon as practicable to the Engineer, CDA, and FAA for approval. No such departures must be made without the prior written approval of the Engineer, CDA, and FAA.
- D. Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor must be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections, unless otherwise authorized in writing by the Engineer, CDA, and FAA or shown in the Drawings.
- E. In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points must be installed at locations shown on the Drawings. Cable circuit identification markers must be installed on both sides of the L-823 connectors installed or at least once in each access point where L-823 connectors are not installed.
- F. Provide not less three feet of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections,

provide enough slack to allow the cable to be extended at least one foot vertically above the top of the access structure. This requirement also applies where primary cable passes through empty base cans, junction and access structures to allow for future connections, or as designated by the Engineer, CDA, and FAA.

48.02 INSTALLATION IN CONDUIT

- A. This item includes the installation of the cable in duct or conduit as described below. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable must be in accordance with the Chicago Electric Code.
- B. The Contractor must make no connections or joints of any kind in cables installed in conduits or ducts.
- C. The conduit must be installed as a separate item in accordance with Section L-110, "Installation of Airport Underground Electrical Duct." The Contractor must run a mandrel through duct banks or conduit prior to installation of cable to insure that the conduit is open, continuous, and clear of debris. The Contractor must swab out all conduits/ducts and clean base can, manhole, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the base cans and all accessible points of entry to the duct/conduit system must be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc. is incidental to the pay item being cleaned. All raceway systems left open, after initial cleaning, for any reason, must be recleaned at the Contractor's expense. All accessible points must be kept closed when not installing cable. The Contractor must verify existing ducts proposed for use in this project as clear and open. The Contractor must notify the Engineer, CDA, and FAA of any blockage in the existing ducts. The cable must be installed in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering. The ends of all cables must be sealed with moisture-seal tape before pulling into the conduit, and it must be left sealed until connections are made. Where more than one cable is to be installed in a conduit or duct under the same Contract, all cable must be pulled in the conduit or duct at the same time. The pulling of a cable through ducts or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Installation of cable in ducts must be carried out by the use of nylon or polypropylene pull lines. Flat steel tapes or steel cables must not be used. Pulling tensions must be governed by recommended standard practices for straight pulls or bends and must not exceed manufacturer's recommendation. The Contractor must submit pulling tension values to the Engineer, CDA, and FAA prior to any cable installation. If required by the Engineer, CDA, and FAA, pulling tension values for cable pulls must be monitored by a dynamometer in the presence of the Engineer, CDA, and FAA. Cable pull tensions must be recorded by the Contractor and reviewed by the Engineer, CDA, and FAA. Cables exceeding the maximum allowable pulling tension values must be removed and replaced by the Contractor at Contractor's expense. A lubricant recommended for the type of cable being installed must be used where pulling lubricant is required. All cable must be installed directly from reels. Dragging the cable over the ground and across base can or manhole edges is not permitted. When cable must be coiled, lay cable out on a canvas tarp or utilize other appropriate means to prevent abrasion to the cable jacket.

- D. Cable installation, handling, and storage must be per manufacturer's recommendations. During cold weather, particular attention must be paid to the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the Engineer, CDA, and FAA, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

48.03 SPLICING

- A. For 5KV series circuit airfield lighting, the connections of the type required in the Plans must be made by experienced personnel regularly engaged in this type of work and must be completed in accordance with the following:
1. Field-attached or Plug-in Splices. (5KV Splices) These must be assembled in accordance with the National Electrical Code and manufacturer's recommendations. These splices must be made with compression type connectors or lugs plugging directly into mating connectors. In all cases the joint where the connectors come together must be cleaned, taped and encased with heat shrink tubing. Indenter type compression fittings are not acceptable. Provide tape and heat shrink tubing over all cable splices in manholes, handholes, and light bases.
 2. For splicing cables with L-823 plug and receptacle cable connectors, see Paragraphs 2.04A, 2.04B, and 2.05 above.
 3. Every splice must be housed in a light base, handhole, or manhole. In a light base, leave at least 6 feet of slack cable on each side of the splice. In a handhole or manhole, the cable must make one loop around the handhole or manhole and the splice must be located near the center of the loop.
- B. For power cable splicing above 600 Volt, splices and terminations will not be permitted except in junction boxes, manholes and handholes. These must be assembled in accordance with the National Electrical Code and manufacturer's recommendations. Splices and terminations must be made with compression type connectors and lugs for medium voltage use. Splices must only be made where necessary when pulling tensions exceed manufacturer's recommendations. Lugs will only be allowed in above ground enclosures or junction boxes. Lugs must be 2-hole, color keyed only and installed with tools as required by the lug manufacturer. Lug bolting and solderless lug terminations must be per manufacturer's recommendation for medium voltage.
- C. For 600 Volt and lower cables, splices and terminations will not be permitted except in junction boxes, pad-mounted transformers, manholes, and handholes. These must be assembled in accordance with the National Electrical Code and manufacturer's recommendations. Splices and terminations must be made with compression type connectors and lugs. Splices must only be made where necessary at branches or where pulling tensions exceed manufacturer's' recommendations. The lug manufacturer's recommended tools must be used. Indenter type compression fittings are not acceptable. Lugs must be 2 hole, color keyed. Lug bolting must include a flat washer, a Belleville washer and a locknut. All stranded wire must be terminated with solderless lugs.
- D. The Contractor must splice underground signal (control, telephone) cables as follows:

1. Kit and Resin: The splices must consist of a rigid polypropylene mold body with a built-in spacer web to provide cable centering and proper compound coverage. The mold body must be filled with a flexible polyurethane electrical compound capable of continuous operation at 90 degrees C, with an emergency overload temperature rating of 130 degrees C. Splices must have provisions for inline splicing of shielded or non-shielded plastic or rubber-jacketed control (telephone) cables. The splices must be rated for direct burial applications. For control cables with outside diameters between 0.25 inches and 3.25 inches, 3M Scotchcast Signal and Control Cable In-line Splicing kits of the 72N series meet these Specifications, and are acceptable.
2. Connectors: Control cable splice connectors must be in-line type, in which two conductors are spliced by laying one conductor in each end of the connector and crimping the connector with a special tool selected to match the connector type and size. Before crimping, the connector is open on one side of its length. After crimping, the connector is closed all around its length. The connector bodies must be made with a tin-plated phosphor bronze piece on the inside, to contact the cable conductors, and bonded polyester insulation on the outside to insulate the connection. The insulation must be color coded to denote wire size range. The cable splice connectors and tools must incorporate the insulation displacement termination technique which uses a slotted, tin-plated contact to displace the conductor insulation, thus providing four redundant electrical contact points. Connectors which require prestripping the conductor must not be used. Tyco Amp, Inc (Harrisburg, PA) Picabond connectors sized for conductor size and matching AMP tooling, meet these Specifications and are acceptable.

48.04 COUNTERPOISE OR GUARD WIRE INSTALLATION FOR LIGHTNING PROTECTION.

- A. Counterpoise or guard wire must be installed for lightning protection of the underground cables. Counterpoise or guard wire must be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield lighting cables and/or FAA copper conductors. In trenches counterpoise or guard wire must be installed continuously a minimum of 4 inches above the cable, conduit or duct bank, or as shown on the Drawings if greater. Additionally, counterpoise or guard wire must be installed at least 8 inches below the top of subgrade in paved areas or 10 inches below finished grade in un-paved areas. This dimension may be less than 4 inches where conduit is to be embedded in existing pavement. Counterpoise or guard wire must not be installed in conduit. Refer to paragraph 2.02B as to where counterpoise wire or guard wire is required. The counterpoise wire must be exothermically welded to ground rods spaced a maximum of 500 feet apart around the entire circuit. The guard wire must be exothermically welded to ground rods spaced a maximum of 90 feet apart around the entire circuit. Refer to paragraphs 2.02C and 2.02D for airfield lighting counterpoise size and FAA guard wire size, respectively.
- B. The counterpoise or guard wire must be routed around each edge light fixture base, handhole and manhole. Connection is not made to light fixture base can (edge light), handhold or manhole. The requirements for counterpoise must conform to the FAA Advisory Circular AC 150/5340-30 (latest revision), Chapter 12, paragraph 12.5 "Counterpoise" (Lightning Protection). The counterpoise or guard wire must also be exothermically welded to-ground rods installed as per these Specifications.

- C. For in-pavement runway touchdown zone lights, runway centerline lights and taxiway centerline lights installed in rigid pavement the counterpoise connections are made to the exterior ground lug on fixture bases and bonded to the rebar cage around the fixture base. The counterpoise wire must also be exothermically welded to ground rods installed as shown on the Drawings, but not more than 500 feet (150 m) apart around the entire circuit.

48.05 SAFETY (EQUIPMENT) GROUND

- A. A separate safety (equipment) ground system must be provided in addition to the counterpoise wire. The requirements for safety ground must conform to the FAA Advisory Circular AC 150/5340-30 (latest revision), Chapter 12, Paragraph 12.6 "Safety (Equipment) Ground" and as shown in the Drawings. The equipment ground must not run in conduit between fixture bases.
 - 1. A ground rod must be installed at and securely attached with a size 6 AWG bare jumper to each airfield in-pavement light fixture base can.
 - 2. For each electrical manhole, bond all metal surfaces to the 4/0 AWG bare stranded copper ground bus utilizing size 2 AWG pigtail bare copper cables.
 - 3. For each electrical handhole, bond all metal surfaces to the 4/0 AWG stranded copper insulated ground bus utilizing size 2 AWG pigtail insulated cables. Insulation must be green, Type XHHW.
 - 4. For each Type 1 marker base handhole, bond all metal surfaces to the ground rod in the handhole using size 6 AWG green insulated wire.

48.06 COUNTERPOISE OR GUARD WIRE INSTALLATION ABOVE MULTIPLE CONDUITS AND DUCT BANKS

- A. Counterpoise or guard wires must be installed above multiple conduits/duct banks for airfield lighting or FAA copper cables, to provide a complete cone of protection over the cables. When multiple conduits and/or duct banks are installed in the same trench, the number and location of counterpoise or guard wires above the conduits must be adequate to provide a complete cone of protection measured 22 ½ degrees each side of vertical. For ductbank of extra width, multiple counterpoise or guard wires may be required.
- B. Where duct banks pass under pavement to be constructed in the Project, the counterpoise or guard wire must be placed above the duct bank.

48.07 COUNTERPOISE OR GUARD WIRE INSTALLATION AT EXISTING DUCT BANKS

- A. Where new ductbank is to connect to an existing ductbank and counterpoise/guard wire system, the new counterpoise or guard wiring must be terminated at ground rods at the end of the existing duct bank. The new counterpoise or guard wire must be bonded to the existing counterpoise or guard wire system in accordance with these Specifications.

48.08 EXOTHERMIC BONDING FOR COUNTERPOISE, GUARD WIRE, AND GROUNDING CONDUCTORS

- A. Bonding of counterpoise or guard wire must be by the exothermic welding process. Only personnel experienced in and regularly engaged in this type of work must make these connections.

- B. Contractor must demonstrate to the satisfaction of the Engineer, CDA, and FAA, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations must comply with the manufacturer's recommendations and the following:
1. All slag must be removed from welds.
 2. For welds at light fixture base cans, all coated surface areas and "melt" areas, both inside and outside of base cans, damaged by exothermic bond process must be restored by coating with a compound conforming to the base can manufacturer's recommendations.
 3. All buried stainless steel, copper, and weld materials at weld connections must be thoroughly coated with 6 mil of 3M "Scotchkote", or approved equivalent, or coated with coal tar bitumastic material to prevent surface exposure to corrosive soil or moisture.

48.09 INTERFERENCE WITH AIRPORT OPERATION

- A. The normal operating functions of the Drawings will be continued and the work in some areas will be permitted only at specified times and during suitable weather conditions. The installation of equipment and the opening of vital circuits must be done only for minimum intervals at such times and with such restrictions as approved and agreed upon by the Engineer, CDA, and FAA and may be required during non-regular working hours. The installation of temporary wiring may also be required to permit operations and work in certain areas and will be required to maintain operation of all lighting.

48.10 TESTING REQUIREMENTS

- A. The Contractor must furnish all necessary equipment and appliances for testing the underground cable circuits after installation. The Contractor must test and demonstrate in the presence of and to the satisfaction of the Engineer, CDA, and FAA the following:
1. That all lighting power and control circuits are continuous and free from short circuits. This task includes a megger test at the respective Airfield Lighting Vault.
 2. That all circuits are free from unspecified grounds.
 3. That the insulation resistance to ground of all nongrounded series circuits and all nongrounded conductors of multiple circuits is not less than 100 megohms at the Airfield Lighting Vault.
 4. That all circuits are properly connected in accordance with applicable wiring diagrams.
 5. That all circuits are operable. Tests must be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour at each intensity.
 6. That for airfield ground testing other than FAA installations, the impedance to ground of each ground rod does not exceed 25 ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test must be utilized, as described by ANSI/IEEE Standard 81, to verify this requirement.

7. That for all FAA guard wire/FAA ground electrodes, the impedance to ground for each ground rod or connected system for ground electrodes must meet the requirement of FAA-STD-019e, *"Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment"* and FAA-GL-918c *"FAA Great Lakes Region Specification for Construction of Terminal Navigational Aid Facilities"*. Ground resistance requirements related to FAA-ALSF-2 systems is outlined in FAA Specification Number FAA-C-2722, *"Construction of a High Intensity Approach Lighting System With Sequenced Flashing Lights for Category II (ALSF-2) Runways"*.
8. All tests and measurements must be documented in writing for future reference. A log must be maintained for all tests. This log must be certified before completion of the work both as to test value and date of test. The log and all test results must be submitted to the Engineer, CDA, and FAA.
9. All cables must be factory-tested and certified before shipping. The test reports must be submitted and approved by the Engineer, CDA, and FAA before shipping.
10. Tests must be coordinated with the field schedule and field conditions.
11. Before testing, all necessary precautions must be taken to ensure the safety of personnel and equipment. All enclosures for conductors and equipment must be properly grounded.
12. Any faults in the work performed by this Contractor or in materials furnished by this Contractor must be corrected or replaced promptly by this Contractor at his own expense. Any faults in materials furnished by the Contractor which are the result of careless, incompetent or improper workmanship must be repaired and the work retested.

48.11 TESTING PROCEDURES

- A. After home-run cable installation operations have been completed, including splices and terminations, the individual conductors of all cables must have all test requirements listed in Section 3.10.
- B. On all new airfield lighting circuits comprised of all new size 6 AWG-5 KV series circuit conductors, megger testing between fixtures will not be required provided that the 100 megohms requirement is met at the appropriate North or South Airfield Lighting Control Vault per 3.10.A.1, 2, 3.

With reference to new portions or extensions of size 6 AWG-5 KV cable that have been added to existing 5 KV cabling circuit, the megger testing must conform to Paragraph 3.11.G of this Specification and the 100 megohms requirement at the vault per Paragraph 3.10.A.1, 2, 3. Megger testing between fixtures will be required to check for improper grounds if the vault testing with adjusted values for testing based on Paragraph 3.11.G cannot be met.
- C. Any cable which fails to meet any specified tests must be removed and replaced by the Contractor, without added expense to the Contract. Any splice or termination which fails must be repaired or replaced as determined by the Engineer, CDA, and FAA.

- D. All new cables provided due to failures during the warranty or the above specified tests must be tested in the same manner and at the same times as the original new cables provided by this Contract.
- E. The Contractor must maintain a readily available supply of replacement cables so that in the case of a cable failure no delays shall occur in the prompt replacement or repair of the faulty cable.
- F. Tests must be performed in accordance with ICEA and AEIC recommended procedures. The Contractor must notify the Engineer, CDA, and FAA two weeks prior to each test that these tests can be witnessed by the Engineer, CDA, and FAA. Certified copies of all tests must be delivered to the Engineer, CDA, and FAA upon completion of all tests.
- G. Whenever the new 5KV cables are spliced or otherwise connected to existing cables which are older, have a lower insulation level or have a different construction, the test voltage and time duration applied to this combination must not exceed the lower of the specified values for the different types of cable. It must be the Contractor's sole responsibility to check the conditions and to establish these test values before setting up the tests.
- H. Tests must be coordinated with the field schedule and field conditions. Before testing, all necessary precautions must be taken to ensure the safety of personnel and equipment. All enclosures for conductors and equipment must be properly grounded.

48.12 IDENTIFICATION OF CONDUCTORS

- A. Where conductors pass through handholes, manholes and at each side of an L-823 Connector they must be identified with phenolic engraved tags. Each conductor must be tagged at each end of each handhole, manhole, and light base. For the North Airfield (supplied from the North Airfield Lighting Control Vault) the tags must be yellow with black one-quarter inch high lettering and attached with nylon locking ties at each end of the tag. For the South Airfield (supplied from the South Airfield Lighting Control Vault) the tags must be white with black one-quarter inch high lettering and attached with nylon locking ties at each end of the tag. The cable must be thoroughly cleaned before applying the tags. At splices, conductors on each side of the splice shall be tagged. The circuit identification must be as shown on the Contract Drawings and in accordance with Airfield Circuit Identification System.

PART 49 METHOD OF MEASUREMENT

- A. Cable and counterpoise/guard wire installed must be measured by the number of feet measured in place, completed, ready for operation, and accepted as satisfactory.
- B. Separate measurement must be made for each cable or counterpoise/guard wire installed. The footage of wire or cable will be lineal measurement plus two percent for slack of wire or cable. Measurement will be from center to center of manholes, handholes and bases. Additional length for connection of isolation transformers, in handholes, etc. will be included in the appropriate items of this Contract. Connector kits, cable tagging, and electrical testing will not be paid for separately; but, will be included in the unit price for the pay item for wire and/or cable installed. Ground rods and exothermic welding for counterpoise wire and guard wire will not be measured and paid for separately, but are included in the unit price of the pay items in this Specification requiring their installation.

- C. General purpose CONDUCTOR must be measured by the number of lineal feet measured in place, completed, ready for operation, and accepted as satisfactory.

PART 50 BASIS OF PAYMENT

- A. Payment will be made at the Contract unit price per foot for wire and cable installed by the Contractor and accepted by the Engineer, CDA, and FAA of the type specified. This price includes full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and all work necessary to complete this item.
- B. Payment will be made under:
 - 1. POWER CABLE – L-824, TYPE C 5KV, 1/C, #6 AWG, per foot.
 - 2. GROUND WIRE - 1/C, #6 AWG, 600 V, THWN GREEN, per foot.
 - 3. GUARD WIRE – 1/C, 1/0 AWG, 600 V, BARE COPPER, per foot
 - 4. TRACER WIRE – 1/C, #14 AWG, SOLID, INSULATED, ORANGE per foot
 - 5. CONDUCTOR - ALSF-2 FLASHER POWER CABLE, 2–1/C, #2 U.S.E.,per foot

INSTALLATION OF AIRPORT UNDERGROUND ELECTRICAL DUCT SECTION L-110

PART 51 DESCRIPTION

51.01 GENERAL

The work consists of underground electrical conduit and ducts installed in accordance with this Specification at the locations and in accordance with the dimensions, designs, and details shown in the Drawings. The work includes the installation of all underground electrical ducts or underground conduits. It includes the connection of the ducts and conduit into the existing underground electrical system, including all trenching, jacking steel casing where shown on the Plans, backfilling, removal, restoration of any paved areas, connection to new or existing manholes and handholes, concrete encasement, installation of innerducts, mandreling and installation of nylon or polypropylene rope, capping and the testing of the installation as a completed duct system ready for installation of cables, to the satisfaction of the Engineer, CDA, and FAA. The work under this Section is subject to the requirements of the Contract Documents.

51.02 RELATED WORK

- A. Trench Backfilling for FAA Relocations (Section P-157)
- B. Structural Portland Cement Concrete for FAA Relocations (Section P-610)

51.03 REFERENCES

- A. See special provision Basic Materials and Methods for FAA Relocations (Section 16100) for additional requirements

PART 52 EQUIPMENT AND MATERIALS

52.01 GENERAL

- A. Equipment and materials covered by referenced Specifications must be subject to acceptance through manufacturer's certification of compliance with the applicable Specification when so requested by the Engineer, CDA, and FAA.

52.02 POLYVINYLCHLORIDE (PVC) CONDUIT

- A. Non-metallic conduit must be PVC Schedule 40 or Schedule 80 concrete encased as indicated on the Drawings.
- B. PVC conduit, including elbows and couplings, must meet the requirements of NEMA standards TC2 (latest edition), UL Standard 651, Federal Specifications WC-1094A, and must be UL rated and listed for use with 90 degrees C-rated conductors in compliance with Article 352 of the NEC.
- C. The conduit must be manufactured from PVC compound that meets the applicable requirements of ASTM No. D 1784.
- D. PVC conduit fittings must meet with the requirements of NEMA Standard TC3 (latest edition), UL Standard 514 supplement, and Federal Specifications WC-1094A.
- E. All PVC conduit and fittings for communication conduits that will carry fiber optic cables must utilize sweeping bends. The bend must allow for the minimum bending (radius) requirements of the innerduct manufacturer and installer.
- F. Standard PVC fittings and PVC cement adhesive must be compatible with the conduits and must be obtained from the same conduit manufacturers.
- G. Acceptable PVC conduit manufacturers are National Pipe, Carlon (Lamson and Sessions), Cantex, and IPEX.

52.03 PVC-COATED GALVANIZED RIGID STEEL (GRS) CONDUIT

- A. A Polyvinyl Chloride (PVC) coating nominal thickness 0.04 inches (40 mil), will be bonded to the exterior of the conduit. The bond between the coating and the conduit must be greater than the tensile strength of the plastic.
- B. Fittings must be coated in the same manner as the conduit. Fittings must have a PVC sealing sleeve extending from the ends. The sleeve length must be approximately equal to the outside diameter of the conduit or 1-1/2 inches, whichever is smaller.
- C. The PVC coated galvanized rigid conduit must be U.L. listed /labeled. The Manufacturer must submit certified test results from a recognized independent testing company validating that their product meets or exceeds the requirements of ASTM D870-02 Testing Water Resistance of PVC Coating Using Water Immersion and ASTM D2247-02 Testing Water Resistance of PVC Coating in 100% Relative Humidity, to signify compliance to the adhesion performance standards.
- D. A urethane chemical coating must be uniformly and consistently applied to the interior of the conduit and fittings. The internal coating must be applied at a minimum thickness of 2 mils.
- E. Provide solvent cement and patching compound as recommended by the manufacturer for sealing joints and repairing gouges and cuts.

- F. Provide PVC coating cement and patching compound as recommended by the PVC coated conduit and fitting manufacturer.
- G. PVC coated conduit and fittings must be 1 inch trade size or larger.
- H. Galvanized rigid steel conduit heavy wall must be milled steel, hot-dip galvanized conduit, complying with ANSI C80.1 and Federal Specification WWC-581 and must be U.L. listed.
- I. Elbows, bends, and fittings must be made of full weight materials and must comply with the above and threaded the same as conduit.
- J. Threads for conduit, couplings and fittings must be full depth and clean cut. Field cut threads must be coated with Coppercoat or in accordance with manufacturer's instruction.

52.04 CONCRETE

- A. Concrete used to form duct banks with conduit must be as specified in Section P-610 Structural Portland Cement Concrete. Reinforcing bars where required will be as shown on the Drawings and in accordance with P-610.

52.05 INNERDUCT

- A. Materials for innerducts for airfield communication cables will be subject to acceptance through manufacturer's certification of compliance with applicable Specifications.
 - 1. All innerduct must be provided with a pull rope.
 - 2. Footage label must be sequentially marked on the innerduct.
- B. Outdoor Installations
 - 1. Innerduct that is to be installed outside, as indicated in the Contract Drawings, must meet the following requirements:
 - a. The innerduct must meet or exceed the minimum standards of PE334470E/C as defined in ASTM D3350.
 - b. The innerduct must conform to ASTM F2160.
 - c. As indicated on the Contract Drawings, provide 1.00-inch for FAA or 1.25-inch for CDA innerduct for outdoor applications. The innerduct must meet the following Specifications.

(1)	Type	Solidwall
(2)	Wall Construction	SDR 11
(3)	Material	High Density Polyethylene
(4)	Color	Yellow for FAA single mode fiber; grey for FAA copper control cable; orange for all other applications.
 - d. All solid wall innerduct, after final length trimming in manholes or building entrances, and prior to any cable installations within the innerduct must be reamed at the inside diameter edge at both ends of the innerduct to provide a smooth, rounded edge for protection to all copper and fiber optic cables and cable jacketing.
- C. Indoor Installations

1. Innerduct that is installed indoors, as indicated in the Contract Drawings, must meet the following requirements.
 - a. The plenum rated innerduct must be recognized per NEC Articles, 770 and 800 for Plenum, Riser and General Purpose Raceway for optical fiber and telecommunications cables.
 - b. The riser rated innerduct must be recognized per NEC Articles, 770 and 800 for Riser and General Purpose Raceway for optical fiber and telecommunications cables.
 - c. The innerduct must conform to UL 2024.
 - d. As indicated on the Contract Drawings, provide 1.00-inch plenum or riser rated innerduct for FAA indoor applications. The innerduct for indoor applications must meet the following Specifications.
 - (1) Type Corrugated
 - (2) Material PVC (Riser Rated)
PVDF Resin (Plenum Rated)
 - (3) Inner Diameter 1.05 inches (+0.010 inch,
-0.020 inch)
 - (4) Outside Diameter 1.31 inches (+0.010 inch,
-0.020 inch)
 - e. As indicated on the Contract Drawings, provide 1.25-inch plenum or riser rated innerduct for CDA indoor applications. The innerduct for indoor applications must meet the following Specifications.
 - (1) Type Corrugated
 - (2) Material PVC (Riser Rated)
PVDF Resin (Plenum Rated)
 - (3) Inner Diameter 1.38 inches (+0.010 inch,
-0.020 inch)
 - (4) Outside Diameter 1.65 inches (+0.010 inch,
-0.020 inch)
 - f. Innerduct color must be yellow for FAA single mode fiber, grey for FAA copper control cable, and must be orange for all other applications.

D. Pull Rope

1. Provide pull rope in all innerduct with minimum pull strength of 1250 pounds for outdoor applications and 900 pounds for indoor applications. The pull rope must extend 6 feet beyond the termination at each end.

E. Duct Plugs and Conduit Seals

1. Duct plugs and conduit/innerduct seals must be constructed of high impact plastic and fully corrosion resistant. Where fasteners are required they must be stainless steel. The duct plugs and conduit/innerduct seals must provide a water tight and gas tight installation. The devices must be easily installed or removed. The design must be of a split type configuration for retrofitting without any disassembly of existing conduits, innerducts, or cables. The compressible gaskets must be elastic, expandable, and durable for a permanent or temporary installation. Where conduits or innerducts contain pull ropes or cords the plug devices must have internal fastening loops to secure the rope or cord with slack within the conduit or innerduct for access at a later date during cable

installations.

- a. Blank Duct Plugs – Compression type mechanical plugs must be installed to seal spare conduits and spare innerducts of various sizes at all building/facility entrances and at the first manhole or handhole outside of the building/facility entrance. Plugs are to be sized per conduit inside diameters as required.
- b. Innerduct Seals – Compression type mechanical seals must be provided to seal annular space around innerducts within conduits at all building entrances and at the first manhole or handhole outside of the building/facility entrance. Seals must be split type that can be installed around existing innerducts that are in place with or without cable.
- c. Cable Seals – Compression type mechanical seals must be provided to seal all cable entrances in conduits and all cable entrances in innerduct at all building entrances and at the first manhole or handhole outside of the building/facility entrance. Fiber optic cable are installed individually, one cable of various diameter within one innerduct. 5KV or 600 volt power cables must have seals selected per total number of cables, diameter of cables, and conduit sizes as required.

F. Pulling Lubricant

1. A water based propylene glycol solution must be used when placing innerduct into duct banks as well as placing cable into innerduct.
2. The lubricant must have characteristics intended for the pulling of MDPE and HDPE fiber sheaths through PVC innerduct.

G. Provide all fittings, terminations, connectors, etc. for a complete integrated raceway system.

H. Acceptable innerduct manufacturers are Carlon, EW&C and Innerduct.

PART 53 CONSTRUCTION METHODS

53.01 GENERAL

- A. The Contractor must install underground duct banks at the locations and grades as indicated in the Drawings. Conduits must be of the size, material, and type indicated in the Plans or Specifications. Where no size is indicated in the Drawings or Specifications, the conduits must not be less than 3 inches inside diameter. All duct banks must be laid to pitch toward structures for drainage as shown on the Drawings. Pockets or traps where moisture may accumulate are not acceptable unless pre-existing underground field conditions prohibit ductbank pitch to structure.
- B. The Contractor must mandrel each conduit. After completion of construction, each conduit must first be thoroughly cleaned before being mandrelled. Cleaning can be accomplished by drawing a wire duct brush, a flexible mandrel or power water rodding/jetting through each conduit to make sure that no foreign materials are left in the conduits after construction. When cleaning is completed, each conduit must be

mandrelled with a non-flexible, durable, wood or metal conduit mandrel made specifically for this purpose. The diameter of the mandrel must not be more than ¼ inch smaller in diameter of the bore of the conduit and the length of the mandrel must be at least 1 inch longer than the diameter of the bore.

- C. Conduit installed must be provided with a nylon or polypropylene rope for pulling the permanent wiring. Sufficient length must be left in handholes and secured to prevent it from slipping back into the conduit.
- D. Conduit must be securely fastened in place during construction and progress of the work and must be plugged to prevent seepage or grout, water, or dirt. Conduits must be placed on supports/spacers designed and manufactured for this specific purpose. When not being worked, conduits must be capped using metal or plastic caps designed for this purpose. The use of materials such as rags, paper, plastic bags or tape is forbidden. Any duct bank having a defective joint must not be installed.
- E. Conduit must be encased in concrete, with a 3 inch minimum concrete envelope poured around all conduit.
- F. Where turf is well established and the sod can be removed, it must be carefully stripped and properly stored and replaced after backfilling in accordance with Section 3.06, as directed by the Engineer, CDA, and FAA.
- G. Trenches for conduit and ducts may be excavated manually or with mechanical trenching equipment. Walls of trenches must be essentially vertical so that a minimum of base material or soil is disturbed.
- H. Dozers, wheel loaders, or motor graders must not be used to excavate the trench. The Contractor must ascertain the type of soil or rock to be excavated before bidding. All excavation material will be unclassified. Work shall be performed in accordance with Section 3.08-Unclassified Excavation.
- I. Conduit must be provided with slip couplings where it crosses through or under transverse construction joints in Portland cement concrete pavement.
- J. Conduit must be provided with approved expansion and deflection couplings where it crosses through expansion joints.
- K. PVC-Coated Galvanized Rigid Steel Conduit must be provided with grounding bushings to insure continuity of ground for the underground electrical system. The grounding bushings must be threaded onto the conduit.
- L. The Contractor must connect into the electrical duct bank system at the location indicated on the Plans by core drilling into structures, by connecting to existing conduit or ducts, or as directed by the Engineer, CDA, and FAA.

53.02 CONDUIT ENCASED IN CONCRETE

- A. Unless otherwise shown in the Plans, concrete-encased conduit must be installed so that the top of the concrete envelope is not less than 30 inches below the finished subgrade where installed under runways, taxiways, aprons, or roads, and not less than 30 inches below finished grade where installed in unpaved areas. Ducts under paved areas must extend at least 5 feet beyond the edges of the pavement or 5 feet beyond any underdrains which may be installed alongside the paved area. Trenches for

concrete encased conduit must be opened the complete length before concrete is laid, so that if any obstructions are encountered, proper provisions can be made to avoid them. Concrete for the duct must be placed to form a single unit, not incrementally. The concrete cover thickness must be a minimum of three inches on all sides. Where two or more conduits are encased in concrete, the Contractor must space them not less than 2 inches apart (measured from outside wall to outside wall) using spacers applicable to the type of conduit. End bells or end couplings must be installed flush with the end of the concrete encasement where required.

B. Tracing FAA and Common Electric Ductbank (CED) Containing FAA Fiber

Tracer wire is required by the FAA to trace and locate concrete encased ductbank containing FAA fiber optic cable. Tracer wire will allow traceability of a fiber optic cable segment into and out of all facilities along the path of the specific fiber optic cable FOTS loop for every facility with FAA fiber optic equipment connected to the cable being traced.

Because the routing of FAA fiber optic cable for Communication FOTS loops and NAVAID (ILS) FOTS loops often follow the same ductbank route, the number of tracer wires in a given ductbank will vary as required to achieve traceability of each segment on a whole fiber optic loop. Most ductbanks will require only a single tracer wire, however other short facility branch ductbanks from the main would require multiple tracer wires when fiber optic cable segments overlap. When in the case of a NAVAID fiber optic cable loop which can double back on itself, at a facility that uses a single ductbank branch to access both of the cable segments serving it by ductbank with multiple segment entrances, 2 or 3 tracer wires would be required within that short ductbank branch to the FAA site/shelter. Where tracer wires converge at the lower level, Concourse "E" and "G" entrances of the main terminal, and the south entrance to the SATCT three (3) tracer wires within a common ductbank would be needed.

All new fiber installations and tracer wire routings for design packages must be coordinated with the CDA and FAA to conform with the overall or master Airport FAA fiber routing plan developed by FAA.

1. Provide and install 6" wide red plastic warning tape above all ductbanks and #14 AWG insulated copper tracer wire within all FAA dedicated ductbanks, handholes and manholes; all Common Electrical Ductbanks (CED), handholes and manholes containing FAA fiber optical cable; and existing ductbanks, handholes and manholes when used to route FAA fiber. (These requirements apply to both single-mode FAA fiber and multi-mode FAA fiber installations).
2. Tracer wire must be placed by the contractor installing FAA fiber optic cable to follow the entire fiber segment route between FAA buildings and facilities through new infrastructure and existing infrastructure. It is the contractor's responsibility to coordinate all fiber tracer wire requirements with the CDA and FAA for all new FAA fiber work or expansion of existing fiber/tracer wire work.
3. The tracer wire must be #14 AWG insulated solid copper wire. The insulation color must be orange for multi-mode fiber. The tracer wire must be placed with the installation of innerduct within a conduit in conjunction with the later

installation of FAA fiber cable in that contract. The tracer wire should optimally be pulled in with the innerduct, in the conduit void between innerducts or in a FAA spare innerduct with the FAA's approval and is run continuously from FAA facility/shelter to FAA facility/shelter without splices. Within manholes or handholes the tracer wire must be fastened to the cable racks and tagged "FAA Fiber Optic Tracer Wire".

4. The tracer wire must follow the entire run of FAA fiber optic cable segments from Airport Traffic Control Tower or Concourse lower level duct entrances into and out of each of the respective FAA NAVAID and Communication / Radar facility to accommodate the tracing of each fiber segment. Tracer wire is not required beyond the Concourse ductbank entrances, in the lower level Concourse tunnels or to the ATCT. A separate tracer run in general follows each fiber segment from building to building and will not be shared nor spliced / tied together.
5. When the tracer wire is brought into a facility it will not be terminated. The tracer wire must be coiled in an interior mounted fiber optic junction box . The contractor must provide ten (10) feet of cable, coiled and tagged "FAA Fiber Optic Tracer Wire". The junction box must also be tagged "FAA Fiber Optic Tracer Wire".
6. Tracer wire continuity between facilities along each fiber optic cable segment must be demonstrated by the contractor to the FAA for acceptance.
7. When a field manhole tracer wire splice is required due only to the cable spool limitations the splice must be made with approved mechanical type connectors, Burndy type copper un-insulated type as directed by the Director and the FAA. The connection must also be wrapped with electrical tape.
8. In the event tracer wire is damaged or rendered inoperable during the course of construction activities, the contractor will be responsible to re-establish or install new tracer wire between facilities.

C. ComEd Ductbank, Common Electrical Ductbank (CED) Warning Tape

1. Unless the ComEd Ductbank or Common Electrical Ductbank is being jacked in place, or the Plans indicated otherwise, a 6 inch wide red plastic warning tape must be placed 12 inches below grade directly over the entire length of a proposed ComEd Ductbank or Common Electrical Ductbank. The CED ductbanks contain as part of the CDA/OMP both electrical power and communications assigned cells.
2. The plastic warning must be colorfast and chemically inert. Clips for bonding tears and completing end-of-roll splices must be provided and installed per manufacturers' recommendations.

53.03 INNERDUCT INSTALLATION

A. Equipment

1. Cable tuggers, tension metering equipment, break-away swivels, sheaves, quadrant blocks, hooked hanger sheaves, cable feeding sheaves, corner cable guides, reel trailers, reel trucks and continuous lubricating equipment are the most suitable types of equipment for this Project; however, the Contractor must

make its own determination and selection of the equipment to use to install the innerduct.

2. Use pulling means, including fish tape, cable rope and basket weave innerduct grips that will not damage the innerduct media or raceway. Pull innerducts simultaneously in the same raceway as shown on the Drawings with equipment to equalize pulling tensions on each innerduct. A reliable non-freezing type of swivel must be inserted between the pulling line and the innerduct grips to prevent twisting under strain. The swivel must be equipped with shear to tension pins with a breaking strength recommended by the innerduct manufacturer. Pulling equipment must be equipped with a hydraulic bypass which must be set so that a maximum tension (recommended by the innerduct manufacturer) is not exceeded.
3. Prior to being installed, multiple innerducts must be bundled and secured with lashing ties per the manufacturers recommendations. The lashing ties must be installed every two (2) meters.

B. Joints and Breaks

1. Innerducts must be installed continuous in the ductbank. No joints or breaks of any kind will be allowed in any of the innerduct segments. Innerduct breaks are allowed only in manholes/handholes/pullboxes and at Panel locations.

C. Placing Innerduct In Segments

1. Contractor must utilize secured sheaves and quadrant blocks to guide the innerduct from reels above the manhole or from buildings into the manhole chamber and into the 4 inch conduit. Contractor must maintain tension on the innerduct from the supply reel to the 4 inch conduit.
2. Contractor must lubricate the innerduct at the point that it enters the conduit. Use pulling compound or lubricant as recommended by the innerduct manufacturer. Contractor must use a lubricant application system to minimize lubricant loss and spillage in the manhole and/or immediate work surface area. All spilled lubricant must be cleaned completely from the surfaces of the manhole and work surface area.

D. Manhole Terminations

1. The innerduct must enter the manholes through conduit fittings cast into the side of the manholes.
2. To compensate for innerduct elongation due to installation pulling stress and installation temperature, the Contractor must pull the multiple innerducts past the conduit system and/or manholes to allow the innerduct to recover to its original length. The amount of innerduct left after the initial cutting in manholes must be coordinated with the innerduct manufacturer. This coordination must take into account allowable pulling tension, pulling techniques/equipment, conduit conditions, length of innerduct pulls, size/quantity of innerducts per conduit, and installation temperature. The time needed for innerduct recovery must be per innerduct manufacturer's requirements prior to the final innerduct trimming to 6 inches extending out of the interior side of the manhole wall. Any innerduct

improperly trimmed or compensated for elongation, that contracts into the conduit after relaxation must be removed and replaced at the Contractor's expense.

E. Building Terminations

1. The innerduct must enter the buildings through 4 inch conduit fittings. Mechanical compression type seals are to be installed based on quantity and size of innerducts to provide a water and gas tight seal.
2. After installation of innerduct seals, Contractor must cut all HDPE innerduct per manufacturer's requirements as described in Paragraph 3.04.D.2. If the Contract Drawings call for the innerduct to continue from the building wall, an innerduct transition piece must be installed and plenum rated innerduct is to be connected to it and extended into the building.
3. Contractor must provide an innerduct connector on all innerduct that is to be terminated onto an enclosure. The connector is to be securely fastened on the innerduct and enclosure. The 4 inch openings in buildings that are not used for innerduct entry must be plugged with a 4 inch blank compression type conduit plug.

F. Innerduct Support

1. Exposed innerduct must be supported in an approved manner. Innerducts must not be fastened to or come in contact with any mechanical system pipes, ducts or equipment of other trades, except as approved by the Engineer, CDA, and FAA. In all innerduct work including vertical runs, acceptable electrical support devices including hangers, racks, ties or a combination thereof must be used as supports.

G. Innerduct and Conduit Mechanical Seals

1. The conduit and innerduct must be sealed with compression type mechanical seals at building penetrations and at the first manhole/handhole to building only.
2. Corrosion resistant compression type mechanical cable seals must be used to terminate the various cables at building entrance conduits and innerducts at buildings.
3. Duct tape must be used to temporarily seal all innerduct segments during the course of construction.
4. Immediately upon installation of an innerduct segment, the Contractor must place duct tape temporarily at both ends of each innerduct in the segment. Contractor must attach the pulling rope to the exterior of the innerduct with duct tape temporarily.
5. At the close of each workday, all innerduct installed as of the end of the workday is to be taped with duct tape to insure that innerducts remain free of liquids and particles.

- H. Prior to installing new innerducts inside existing underground ductbanks, the existing ducts must be cleared and cleaned, If required, clearing and cleaning by mandrelling, power rodding, power washing or other means necessary for the installation of the new innerducts will be included in the unit price for the Innerduct Pay Item.

53.04 DUCTBANK END DELINEATION

- A. In locations where ductbank ends; but, will be extended at a later date, the ductbank ends will be bulkheaded or stubbed and capped below grade. The ends of these ductbanks must be surveyed by the Contractor for their exact locations based on O'Hare Survey Control Monuments (easting and northing of each corner referred to the IL State Plane Coordinates NAD 1983 and the vertical elevation of the top of each corner referred to NAVD 1988). This survey information must be provided and indicated by the Contractor on the As-built Drawings for reference.

53.05 BACKFILLING

- A. After concrete-encased conduits have been properly installed and the concrete has set, the trench must be backfilled in accordance with Specification P-157, Trench Backfilling.
- B. Trenches must not be excessively wet and must not contain pools of water during backfilling operations.
- C. Excess excavated material must be removed and disposed of in accordance with instructions issued by the Engineer, CDA, and FAA.
- D. Material to be used in backfilling under and adjacent to the paved areas must conform to the requirements of Trench Backfill, but the cost of furnishing and placing such backfill must be included in the Contract unit price for the items listed under installation of underground electrical duct.

53.06 RESTORATION

- A. Where sod has been removed, it must be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of soil, cable laying, pay construction, and other work must be restored to its original condition. The restoration must include any necessary topsoiling, fertilizing, liming, or seeding. All such work must be performed in accordance with turfing Specifications. The Contractor must be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

53.07 UNCLASSIFIED EXCAVATION

- A. Provide all excavation for ductbank to the lines and grades for elevations, shown on the Drawings or as stated by the Engineer, CDA, and FAA. The excavation is to be of sufficient size to permit the placing of the full width and length of the ductbank shown. Excavated material is to be stockpiled where directed by the Engineer, CDA, and FAA. The elevations, as shown on the Drawings, are to be considered as approximate only; and the Engineer, CDA, and FAA may order, in writing, changes in dimensions or elevations necessary to secure a satisfactory installation.
- B. Boulders, logs, or other objectionable materials encountered in excavation are to be removed. All rock or other hard foundation material is to be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Engineer, CDA, and FAA. All seams or crevices are to be cleaned out and grouted. Remove all loose and disintegrated rock and thin strata. When concrete is to rest on a surface other than rock, special care is to be taken not to disturb the bottom of the excavation, and excavation to final grade is not to be made until just before the concrete or reinforcing is to be placed.

- C. Provide all bracing, sheathing or shoring necessary to implement and protect the excavation and the ductbank, as well as protect existing adjacent structures located above or below grade as required, as required for safety or conformance to governing laws. The cost of bracing, sheathing or shoring is to be included in the unit price for the ductbank.
- D. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item is to be removed by the Contractor after the completion of the structure. Removal is to be effected in a manner which will not disturb or mar finish masonry. The cost of removal is to be included in the unit price bid for the structure. The Contractor is to notify the Engineer, CDA, and FAA to the effect; and concrete or reinforcing steel is to be placed after the Engineer, CDA, and FAA has approved the depth of the excavation and the character of the foundation material.

PART 54 METHOD OF MEASUREMENT

- A. Underground duct bank and innerduct for fiber optic cables will be measured by the lineal feet of duct bank or innerduct installed, measured in place, completed, and accepted. Measurement will be made from the outer edge to the outer edge of manholes, handholes or connecting structures. Separate measurement will be made for the various types and sizes. No separate measurement will be made for steel casing, ductbank warning, innerduct and conduit mechanical seals, excavation, backfilling, miscellaneous materials or connections to the existing underground ductbank system including removal of standard duct banks and appurtenances within limits of the ductbank trench and layout, and clearing of existing underground ductbank necessary for the installation of new innerducts.

PART 55 BASIS OF PAYMENT

- A. Payment will be made at the Contract unit price per foot of the type and size specified of duct bank and innerduct completed by the Contractor and accepted by the Engineer, CDA, and FAA. This price includes full compensation for furnishing all materials including steel casing where shown on Drawings; for all preparation, assembly, and installation of these materials; for all trenching, jacking and grouting of steel casing and backfilling necessary; for all restoration of disturbed areas; for clearing existing underground ductbank for new innerduct installations, ductbank warning, innerduct and conduit mechanical seals; and for all labor, equipment, tools, and all work necessary to complete this item as required by these Specifications and as detailed on the Contract Drawings.
- B. Payment will be made under:
 - 1. DUCTBANK, 2-WAY, 2" PVC CONDUIT, CONCRETE ENCASED, per foot.
 - 2. DUCTBANK, 2-WAY, 3" PVC CONDUIT, CONCRETE ENCASED, per foot.
 - 3. DUCTBANK, 2-WAY, 4" PVC CONDUIT, CONCRETE ENCASED per foot.
 - 4. DUCTBANK, 5-WAY, (3-WAY 2", 2-WAY 3") PVC CONDUIT WITH 6" SEPARATION, CONCRETE ENCASED per foot.
 - 5. DUCTBANK, 6-WAY, 2" PVC CONDUIT WITH 6" SEPARATION, CONCRETE ENCASED per foot

6. DUCTBANK, 7-WAY, 2" PVC COATED GALVANIZED RIGID STEEL (GRS) CONDUIT, DIRECTIONALLY BORED, per foot
7. DUCTBANK, 2-WAY, 4" PVC COATED GALVANIZED RIGID STEEL (GRS) CONDUIT, DIRECTIONALLY BORED, per foot
8. INNERDUCT, 1", SOLID WALL, SDR-11, per foot

ELECTRICAL MANHOLES AND HANDHOLES FOR FAA RELOCATIONS (SECTION L-115)

PART 56 DESCRIPTION

56.01 GENERAL

A. This item consists of the furnishing of all labor, equipment, and material, and of performing all operations in connection with furnishing and installation of new electrical manholes and handholes and with the adjustment of existing electrical manholes and handholes. The work under this section is subject to the requirements of the Contract documents.

56.02 REFERENCES

A. Refer to special provision Basic Materials and Methods for FAA Relocations (Section 16100) for additional requirements

PART 57 EQUIPMENT AND MATERIALS

57.01 GENERAL

A. Airport equipment and materials covered by Federal Aviation Administration (FAA) specifications are to have the prior approval of the Office of Airport Safety and Standards, Attention: AAS-200, FAA, Washington, D.C. 20591, and are to be listed by FAA's Advisory Circular No. 150/5345-53 (latest edition), "Airport Lighting Equipment Certification Program."

B. All other Airport equipment and materials covered by other referenced specifications will be subject to acceptance through manufacturer's certification of compliance with the applicable specifications, when so requested by the Engineer, CDA, and FAA.

57.02 REINFORCING STEEL

A. Reinforcing steel is to comply with special provision Structural Portland Cement Concrete for FAA Relocations (Section P-610).

B. All existing reinforcing steel exposed during the adjustment of electrical manholes is to be reincorporated into the adjusted structure. Care must be taken not to damage the existing reinforcing steel during concrete removal. The exposed reinforcing steel is to be cleaned of all concrete. Any reinforcing steel rusted, damaged or deemed not retainable by the Engineer, CDA, and FAA is to be replaced with bars of the same size and length meeting the requirements of ASTM A615 Grade 60.

57.03 CONCRETE

- A. Cast-in-place concrete required for the construction of manholes and handholes, and for the adjustment of manholes and handholes is to comply with all the requirements of Section P-610, Structural Portland Cement Concrete.
- B. All manhole and handhole structures that are located within the runway safety area (RSA) or taxiway safety area (TSA) must be designed by a structural engineer to support aircraft loading in accordance with FAA AC 150/5320-6D Appendix 3, Design of Structures for Heavy Aircraft.
- C. Proposed precast concrete mix designs including all ingredients and certified concrete strength test results must be submitted by the Contractor/Precaster prior to manufacturing, for review by the Engineer, CDA, and FAA.

57.04 GROUND RODS

- A. Ground rods are to be $\frac{3}{4}$ inch diameter type 304 stainless steel, 10-feet long minimum.

57.05 FRAMES AND COVER

- A. New frames and covers are to be installed on all electrical manholes and handholes, except where the Drawings indicate otherwise.
- B. The castings must conform to one of the following requirements:
 - 1. Gray iron castings: ASTM A48, Class 30B and 35B
 - 2. Malleable iron castings: ASTM A47
 - 3. Steel castings: ASTM A27
 - 4. Structural steel for grates and frames: ASTM A283, Grade D
 - 5. Ductile iron castings are to meet the requirements of ASTM A536
 - 6. Austempered ductile iron castings: ASTM A897
- C. All castings or structural steel units are to conform to the dimensions and requirements shown on the Drawings and are to be designed to support the loading specified.
- D. Each frame and cover unit is to be provided with stainless steel locking bolts to prevent it from being dislodged but which will allow easy removal for access to the structure.
- E. Each cover must be provided with a latch device that is integral to the cover casting. The latch must be of a spring catch or quarter turn design that is operable with a tool supplied with the casting. Contractor must provide six (6) locking tools at BOD time to be turned over to the FAA District Office. The latching device must secure the cover in a closed position when the hold down stainless steel locking bolts (item 'D' above) are being removed or reinstalled. The cover must be secured by both bolts and latches.
- F. The frames of all electrical and communications manholes and handholes are to be grounded as shown on the Drawings.
- G. All frames and covers installed within the Aircraft Operation Area (AOA) will be aircraft rated for 100,000 lbs. Spring assist frame to be cast into roof or riser section of structure.
- H. Airside Electrical Handhole/Manhole Frame and Cover Schedule

Structure Use	Cover Size and Type	Cover Legend	Notes
FAA Handholes	<p>Per FAA Standards (Drawings and specifications)</p> <p>30" x 30" Opening spring assist, hinged w/bolt down, ductile iron lid</p> <p>Match existing frame and cover size</p>	<p>Per FAA Standards (Drawings and specifications) (See FAA-C-1391b)</p> <p>"FAA 600V-7500V"</p> <p>"FAA Communications" legend on lids are exclusive to FAA NAVAID, FAA Communications, and ALSF sites <u>only</u>. For locations outside FAA facilities/sites and all other locations, the legend on lids must be per CED requirements.</p> <p>"FAA and AT&T Communications" for existing AT&T Manholes to be utilized</p>	<p>Handhole type, Cover Size and Legend to be Coordinated with the FAA</p>

- I. Acceptable manufactures include:
1. Neenah Foundry Company
 2. East Jordan Iron Works, Inc.
 3. Campbell Foundry

57.06 NON-METALLIC CABLE SUPPORT RACKS

A. Manhole and handhole cable racks must be heavy duty, molded, acceptable agency listed, standard yellow fiberglass reinforced nylon with adjustable arms. Length of rack arm must be 14 inches for CED manholes and 6 inches for handholes, respectively. Install cable racks as shown on the Drawings. Secure all cable to the rack arm with separate nylon tie wrap. Acceptable manufacturers of

non-metallic cable support racks are Underground Devices, Inc., Northbrook, IL and StrutTech/Axium Composites, Inc., Redmond, WA. Acceptance is subject to manufacturer's certification of compliance with applicable specifications.

57.07 PULLING IRONS

A. Provide all pulling-in irons, hooks and all other appurtenances as indicated on the Drawings and as required for a complete operational manhole or handhole. Pulling-irons to be manufactured with 7/8-inch diameter hot-dipped galvanized steel.

57.08 EPOXY CONCRETE ADHESIVE

A. The epoxy concrete adhesive must conform to the requirements of Section 1025.01 of IDOT's Standard Specifications for Road and Bridge Construction (latest edition), and meet the approval of the Engineer, CDA, and FAA.

PART 58 CONSTRUCTION METHODS

58.01 UNCLASSIFIED EXCAVATION

A. Provide all excavation for structures to the lines and grades for elevations, shown on the Drawings or as directed by the Engineer, CDA, and FAA. The excavation is to be of sufficient size to permit the placing of the full width and length of the structure shown. Excavated material is to be stockpiled where directed by the Engineer, CDA, and FAA. The elevations, as shown on the Drawings, are to be considered as approximate only; and the Engineer, CDA, and FAA may order, in writing, changes in dimensions or elevations necessary to secure a satisfactory installation.

B. Boulders, logs, or other objectionable materials encountered in excavation are to be removed. All rock or other hard foundation material is to be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Engineer, CDA, and FAA. All seams or crevices are to be cleaned out and grouted. Remove all loose and disintegrated rock and thin strata. When concrete is to rest on a surface other than rock, special care is to be taken not to disturb the bottom of the excavation, and excavation to final grade is not to be made until just before the concrete or reinforcing is to be placed.

C. Provide all bracing, sheathing or shoring necessary to implement and protect the excavation and the structure, as well as protect existing adjacent structures located above or below grade as required, as required for safety or conformance to governing laws. The cost of bracing, sheathing or shoring is to be included in the unit price for the structure.

D. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item is to be removed by the Contractor after the completion of the structure. Removal is to be effected in a manner which will not disturb or mar finish masonry. The cost of removal is to be included in the unit price bid for the structure. The Contractor is to notify the Engineer, CDA, and FAA to the effect; and concrete or reinforcing steel is to be placed after the Engineer, CDA, and FAA has approved the depth of the excavation and the character of the foundation material.

58.02 CONCRETE STRUCTURES

A. Concrete structures are to be built on prepared foundations, conforming to the dimensions and form indicated on the Drawings. Any reinforcement required, is to be placed as indicated on the Drawings and is to be approved by the Engineer, CDA, and FAA before the concrete is poured. Precast manholes and handholes are allowed as long as they meet all requirements of this

specification. Precast units to be installed plumb and true. Joints to be made watertight by use of sealant at each key joint and at roof joint.

B. The interior bottom is to be sloped downward toward the floor drain or outlet. Provide French Drain Sump or piped drain connection to manholes and handholes as shown or indicated on the Drawings.

58.03 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS

A. All castings, frames and fittings are to be placed in the positions indicated on the Drawings or as directed by the Engineer, CDA, and FAA, and must be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts are to be in place and position before the concrete or mortar is placed. The unit is not to be disturbed until the mortar or concrete has set.

B. After the frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for seven (7) days, the grates or covers are to be placed and fastened down.

58.04 BACKFILLING

A. After a structure has been completed, the area around it is to be backfilled in horizontal layers all around the structure not to exceed 8 inches in loose depth, and compacted. The top of the fill is to meet the elevation shown on the Drawings or as directed by the Engineer, CDA, and FAA.

B. All excavations must be backfilled within a reasonable time after the structures are installed, unless other required protection of the structure is directed. Backfill materials and compaction procedures must be acceptable to the Engineer, CDA, and FAA. In all backfilling, any compressible or destructible rubbish and refuse must be removed from the excavated space before backfilling is started, except that sheeting and bracing must be left in place or removed as the work progresses as specified or directed.

C. The backfill material must be brought up evenly on each side of the structure to proposed grade. If under pavement, or within 2 feet of the proposed, future or existing pavement edge, fine aggregate backfill must be placed and compacted until the top of subgrade is reached. If the trench is not under, or adjacent to, existing, proposed or future pavement, then acceptable fill must be placed and compacted to proposed grade.

D. Structures excavated with sloped or bench walls must be backfilled for the full width of the excavation, as herein specified.

E. The backfill material for fine aggregate must consist of natural sand or washed crushed limestone having a FA-6 gradation conforming to Section 1003 of the Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation, latest edition. Acceptable fill for backfill is defined as suitable unclassified excavation material that is non-organic, non-decayable, and non-rubble material having a maximum dry density of not less than 98 pounds per cubic foot. It will contain no rocks, stones, or broken concrete greater than 3 inches in the largest dimension. The material must be easily compactable to the required density and approved by the Engineer, CDA, and FAA.

F. Finish grading must be performed in accordance with the completed contour elevations and grades shown and must be made to blend into the existing or plan ground surfaces. All finished grading surfaces must be left smooth and free to drain. Finish grades must be brought to elevations within plus or minus 0.10 foot of elevations or contours shown.

G. Fine aggregate backfill must be placed in uniform layers not greater than 8 inches in loose thickness and thoroughly compacted in place with suitable vibratory equipment to not less than 95% of the maximum density determined by ASTM D 1557. Each lift of fill must be within +/-2% of optimum moisture content before the succeeding lift is placed. If the backfill is acceptable fill it must be placed in uniform layers not greater than 12 inches in loose thickness and each layer compacted to 85% of maximum density as determined by ASTM D 1557.

H. Backfill compaction must be tested and monitored by the Contractor. All material and backfill operations may be subjected to testing by the Engineer, CDA, and FAA with the assistance of the Contractor.

I. Backfilling is not to be placed against any structure until permission is given by the Engineer, CDA, and FAA. In the case of concrete, such permission will not be given until the concrete has been in place a minimum of seven (7) days, or until tests made by the Contractor's QC organization and tested by the Contractor's approved laboratory, subject to the verification by the laboratory under supervision of the Engineer, CDA, and FAA establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

J. The suitability of compacting equipment must be acceptable to the Engineer, CDA, and FAA. Tamping rollers (generally referred to as Sheepsfoot Rollers) will be considered the proper type of equipment for compaction of cohesive soils and vibratory/mechanical tamping equipment will be applicable for compacting granular soils. In all cases, the adequacy of the equipment will be determined by the Engineer, CDA, and FAA.

K. Any depression which may develop from settlement in backfilled areas within 1 year after the work is fully completed and accepted must be the responsibility of the Contractor. The Contractor must provide as needed, at his own expense, additional backfill material, pavement, base replacement, permanent pavement repairs on replacement and must perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as acceptable to the Engineer, CDA, and FAA.

58.05 HEIGHT ADJUSTMENT OF ELECTRICAL MANHOLES AND HANDHOLES

A. Where indicated on the Drawings and as directed by the Engineer, CDA, and FAA, existing manholes and handholes are to be adjusted to meet new finish grade elevations in accordance with the typical sections as detailed on the Plans. New grade elevations for existing manhole and handholes must match the proposed pavement and/or finish grade elevation at the specified location.

B. When frames or fittings are to be placed upon previously constructed manholes, handholes, and structures, the bearing surfaces are to be brought true to line and grade. The unit is to be set in mortar beds and anchored to the existing manhole or handhole as indicated on the Drawings and as directed and the Engineer, CDA, and FAA. All units are to be set firm and secure.

C. Areas around electrical manholes and handholes that have been disturbed or removed during construction must be restored to meet original conditions as outlined in Paragraph 3.08. Restoration work will not be measured and paid for separately. This work is to be included in the unit price for electrical manhole adjustment.

58.06 APPLICATION OF EPOXY CONCRETE BONDING ADHESIVE

A. Where shown on the detail the epoxy concrete bonding adhesive is to be uniformly applied to coat the entire surface of the concrete remaining in place.

58.07 CLEANING AND RESTORATION OF SITE

A. After the backfilling is completed, the Contractor is to dispose of all surplus material, soil, and rubbish from the site. Surplus soil may be deposited in embankments, shoulders, or as ordered by the Engineer, CDA, and FAA. The Contractor is to restore all disturbed areas to their original condition.

58.08 GROUNDING

A. All non-current-carrying metallic parts of equipment and exposed metal in electrical handholes and manholes must be securely grounded to the grounding conductor. New conductors must be installed in a neat and workmanlike manner and must be securely held in place by means of straps spaced at proper intervals. Exothermic welds must be used to make connections to grounding systems. The grounding requirement is 5 ohms.

B. A ground rod must be installed in the floor of all concrete structures so that the top of the rod extends 6 inches (154 mm) above the floor. The ground rod must be installed within 1 foot of a corner of the concrete structure. Ground rods must be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor must drill a 4-inch diameter hole into the earth to receive the ground rod. The hole around the ground rod must be filled throughout its length, below slab, with Portland cement grout. Ground rods must be installed in precast bottom slab of structures by drilling a hole through the bottom slab and installing the ground rod. Bottom slab penetration must be sealed watertight with Portland cement grout around the ground rod.

C. For manholes, a grounding bus of 4/0 AWG bare stranded copper must be looped around the concrete structure walls and exothermically bonded to the ground rod. The ground bus must be a minimum of 1 foot above the floor of the structure and separate from other cables. Size 2 AWG bare copper pigtailed must bond the grounding bus to all metal hardware within the concrete structure. Connections to the ground bus must be by exothermic welding.

D. For handholes, a grounding bus of 4/0 AWG green insulated Type XHHW, stranded copper must be looped around the concrete structure walls and exothermically bonded to the ground rod. The ground bus must be a minimum of 1 foot above the floor of the structure and separate from other cables. Size 2 AWG green insulated Type XHHW, copper pigtailed must bond the grounding bus to all metal hardware within the concrete structure. Connections to the grounding bus must be by exothermic welding.

58.09 INTERFERENCE WITH OPERATION

A. The normal operating functions of the Airport will be continued while the work under the Contract is being accomplished. Operations and work in some areas will be permitted only at specific times and suitable weather conditions. The installation of equipment and the opening of vital circuits must be done only for minimum intervals at such times and with such restrictions as accepted and agreed upon by the Engineer, CDA, and FAA and may be required during non-regular working hours. The installation of temporary wiring may also be required to permit operations and work in certain areas.

58.10 EXISTING MANHOLE CLEANING AND DEGASSING

A. Pump out any water that may have accumulated in the existing manholes that are a part of the Underground Distribution system where work is to be performed. Remove all dirt and debris from the manholes and dispose of the refuse properly.

B. Pump liquid out of manhole where the work will occur.

1. Pump all clean water to a storm sewer or vegetated swale.
 2. Pick up any oil on top of water by a vacuum truck and properly dispose of per regulations.
- C. Examine the adjacent manholes and pump the liquid out of them to a level below the ducts running to the manhole to be worked in. The liquid level in the adjacent manholes is to be held below the level of these ducts during the work period.
- D. Wash the walls and floor of the manhole that is to be worked in with water. Do not direct water against the cables.
- E. Pump the sediment laden wash water directly into a sediment trap, into a ditch or temporary ditch that leads to a sediment trap, or into sediment containing filter bag that leads to an existing storm sewer or vegetated swale. Discharge hose must have filter fabric or filtering device per EPA requirement.
- F. Gas test the manhole.
1. The first step is to gas test for explosive hydrocarbon and hydrogen sulfide.
 2. If the manhole tests satisfactory for these gases, then test the manhole for the presence of benzene.
 3. The level of concentrations of gas must not exceed those allowed under the Williams-Steiger Occupational Safety and Health Act of 1970. A higher concentration of gas can be tolerated for a shorter duration (in accordance with the Safety and Health Act).
- G. If it is found necessary to decrease the concentration of gas to an acceptable level, fresh air is to be blown into the manhole and exhaust blowers are to be used on adjacent manholes.
- H. If the concentration of gas will permit exposure for a short duration, but is too high for an extended exposure, plug the ducts to adjoining manholes, using untapped, unoiled jute packing (Oakum) or conduit seals. If necessary, blowers are to be used during the plugging operations.
1. Continue to operate the blowers until the gas concentration is acceptable. This may require overnight operation.
 2. Manholes may be further cleaned by using sawdust or mulch to absorb water and oil from manhole floors. This absorptive material is to be removed when the work in the manhole is finished.
- I. Removing the covers from both the manhole to be worked in and the adjacent manholes is also helpful. These covers should be left off after the manholes are pumped out and until the degassing work is completed. Provide barricades for open manholes.
- J. All manholes in the work area, affected by this Contract are to be kept clean during the term of this Project.
1. The presences of liquids, fumes, litter or debris will not be tolerated.
 2. The manhole cleaning and degassing requirement with appropriate and approved modifications, is to be used to obtain clean and dry manholes during the construction period.
 3. Inspection of manholes to maintain the above criteria will be done periodically as

directed by the Engineer, CDA, and FAA.

58.11 DRAINAGE

A. All manholes and handholes must be positively drained, whether it be to an existing or proposed storm sewer structure, or to a French Drain. A removable stainless steel grate is to be installed at the bottom of the structure to allow water to drain. French Drains must be located within 10' of the structure. The contractor must determine whether a nearby storm sewer invert is low enough to accept flow without surcharging water into the new manhole or handhole structure. Contractor must use 4" schedule 40 PVC conduit to connect to existing or proposed drainage structures if available.

B. French Drains are to be constructed as per the Drawings.

(c)

PART 59 METHOD OF MEASUREMENT

A. Manhole and handhole cleaning and degassing, excavation, backfilling, restoration, and appurtenant items will not be measured separately, but will be considered included in the unit price for pay item requiring the work.

B. Drainage for manholes and handholes will not be measured separately, but will be considered included in the unit price for pay item requiring the work.

C. Manholes and handholes must be measured by the number of units installed, measured in place, completed, and accepted.

PART 60 BASIS OF PAYMENT

60.01 MANHOLE AND HANDHOLE

A. Payment will be made at the Contract unit price per each for type of manhole and handhole specified, completed and accepted by the FAA. This price includes full compensation for furnishing all materials; for all preparation, assembly, and installation of these materials; for all dewatering, temporary earth retention system, excavation and backfilling, for all restoration of disturbed areas and for all labor, equipment, tools, and accessories including frame and cover, cable support rack and inserts, ground rod and grounding, ladders and rungs, cable pull irons, other embeds, French Drain Sump or piped drain connection necessary to complete this item as required by these Specifications and as detailed on the Contract Drawings.

B. Payment will be made at the Contract unit price per each for existing manhole cover to be replaced. This price includes full compensation for furnishing all materials, removing the existing cover and installing the new cover.

C. Payment will be made under the Pay Items:

1. FAA ELECTRICAL HANDHOLE, per each
2. NEW COVER ON EXISTING FAA MANHOLE/HANDHOLE, per each

CED/FAA COMMUNICATION MH/HH AS-BUILT CHECKLIST (SECTION L-118)

PART 61 DESCRIPTION

61.01 GENERAL

- A. The scope of this As-built Checklist covers CED and FAA Communication Manholes/Handholes and infrastructures only.
1. The primary purpose of butterfly mapping the CED/FAA Communication MHs/HHs is to establish and provide a continuous and clear route or path for new FAA fiber optic cables from an FAA facility to another FAA facility or to the Air Traffic Control Tower. Where specified elsewhere in the contract documents, the scope of work may include the clearing and cleaning of existing ducts including removal and pulling out of abandoned cables/wires, power washing and mandrelling of existing ducts, and rehabilitation of existing ducts to provide clear paths for new innerducts and fiber optic cables.
 2. The secondary purpose of the MH/HH mapping and documentation is to determine, identify, and establish the remaining conduits/ducts available for future use and to verify their clear path from structure to structure as called for on the Drawings.
- B. The Contractor must prepare a CED/FAA Communication Structure Checklist for each CED/FAA communication structure constructed or existing communication structure altered or utilized. The ENGINEER is the prime responsible group to coordinate, verify, document, and maintain the as-built checklists until transmitted to the Engineer, CDA, and FAA. The Contractor must fully cooperate with and provide all logistic support to the ENGINEER to accomplish the as-built documentation. Work requiring the checklist includes, but is not limited to:
1. installation of communication manholes or handholes (structures),
 2. construction of ductbank entrances to such structures,
 3. installation of communication innerducts in such structures,
 4. installation of copper, fiber optic communication cables and tracer wire (tracer wire installed per Section L-110) in such structures.
 5. items 2-4 above as related to existing communication structures altered.
- The CDA structure identification and label (per CDA naming convention) must be included and used on the form with the structure location (latitude/longitude in NAD 83 format).
- C. The checklist will document and record construction items related to a contract's communication scope of work. If a contract is installing only empty infrastructure then the checklist will document only those items installed (frames and lids, pulling eyes, ground bus, ground rod, cover ground pig tail, duct entrances, duct size and

configuration, etc.). Any future work, by other contracts, such as innerduct installation, innerduct reaming, copper or fiber optic cable installations, tracer wire installations, cable tagging, cable coiling would produce a separate or updated CED/FAA Communication Manhole/Handhole Checklist documenting those items within the contract's communication scope of work and noting any other existing installations.

- D. The manhole/handhole checklist form includes a section where the Contractor will sketch the butterfly mapping of the structure with wall faces A, B, C, and D references to true ductbank entrance compass configuration. Depending on the project scope, the mapping will record number, size, configuration of cells per wall, the number, size, location of innerducts per cell, tracer wire and location, fiber optic designations, and cable tagging. The form utilizes a small standard ductbank illustration for each wall and requires larger separate sketches to be prepared and attached, if necessary, to clearly document the ductbank configuration for each wall of the structure. The Contractor should indicate and label existing cables to the extent that he sees them and cable tags that exist; the Contractor is not responsible for or labeling any existing cables that don't have cable tags or tracing cables to determine what they are or verifying the accuracy of existing cable tags (unless the Contractors' scope of work specifically includes this additional labeling verification or coordination with FAA or CDA agencies).
- E. To determine a clear path, the Contractor must investigate spare ducts within a structure to allow the communications cabling to route through the structure. Depending on communication system being installed, the Contractor must designate if existing spare innerducts in that system exist, and, if so, are the spare innerducts usable to achieve the systems clear path required. Where no spare ducts or innerducts exist, the Contractor must identify any cables that are tagged as abandoned that may be cleared to provide a spare duct for establishing a clear path. When a clear path has been established by cleaning and mandrelling or by cable removal operations, that duct must be left with a pull cord with tag indicating the clear path duct established. Clear path ducts must be indicated on the manhole/handhole checklist. The tag must alert that the identified duct(s) are dedicated to a specific agency and unauthorized use by others is prohibited.

61.02 SUBMITTALS

- A. Duly accomplished CED/FAA Communication MH/HH As-built Checklist (pages 1 and 2) – Refer to attachment.
- B. Pictures or photographs of the manholes/handholes, as required by the Engineer, CDA, and FAA.

61.03 RELATED WORK

- A. As specified in the following special provisions:
 - 1. Electrical Manholes and Handholes for FAA Relocations (Section L-115)
 - 2. Fiber Optic Cable and Equipment for FAA Relocations (Section 16125)
 - 3. Installation of Underground Cable for Airports (Section L-108)
 - 4. Installation of Airport Underground Electrical Duct (Section L-110)

PART 62 MATERIALS (N/A)

PART 63 EXECUTION

63.01 GENERAL

- A. The CED/FAA Communication Manhole/Handhole Checklist forms must be incorporated into the projects As-built document submittal. The documentation must also include a tabulation sheet that numbers each cell per wall, listing work per cell installed will be compiled by the CDA as new contracts and new cabling populate the CED/FAA communication duct/structure system. As a revision block is to a drawing for recording all changes, the checklist will record and document all cabling work and structure build out within a respective CED/FAA communication structure. The checklist will be used as a tool to manage cable installations and plan for future use and expansions. The Contractor will be responsible for labeling and signing off as accurate as part of the checklist any cables, tracer wires, or other work the Contractor installed or performed as part of the construction contract.
- B. As-built checklists prepared by the Contractor and verified as performed by the ENGINEER must be provided to CDA/FAA upon substantial completion of individual component/phase of work when there is a transfer of building/infrastructure occupancy, and not after the completion of the entire project. Prior to pulling fiber optic cables through a loop by the FAA or other Contractor, the MH/HH as-built checklists for that entire loop must be submitted to CDA and FAA.
- C. The Contractor is required to provide redlined .pdf files prior to the Building Occupancy Date (BOD). Computer Assisted Drawing (CAD) .dgn files of pertinent as-built FAA drawings will be prepared by the Engineer of Record or other provider of Construction Phase Services within 90 days of BOD for limited segments of work associated specifically with the BOD deliverable, based upon the .pdf files.

PART 64 METHOD OF MEASUREMENT

64.01 MEASUREMENT

- A. All work associated with the preparation, mapping, tagging, and documentation of the CED/FAA Communication MH/HH As-built Checklist will not be measured separately for payment, but will be considered included in the overall Contract.

PART 65 BASIS OF PAYMENT

65.01 PAYMENT

- A. All costs associated with the preparation, mapping, tagging, and documentation of the CED/FAA Communication MH/HH As-built Checklist as described in this Section, will not be paid for separately but are included in the overall Contract price. No additional time or monies will be granted to the Contractor for compliance with the requirements of this Section.
- B. Where required, the cost of the work to clear, clean, or rehabilitate existing conduits/ducts to provide clear paths and routing for new fiber optic cables will be paid for separately under separate Sections of this Contract.

Project Name: _____
OMP Project No: _____
Contractor: _____
Electrical MH/HH No.: _____
Electrical MH/HH Lid Label: _____

Date: _____

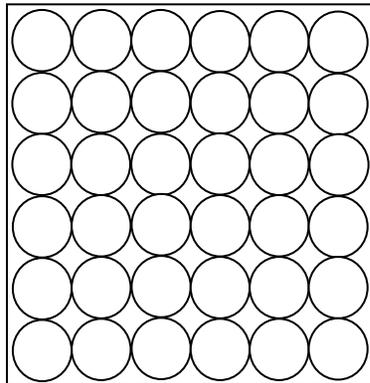
Location: _____

(Lat./Long. In NAD 83 Format)

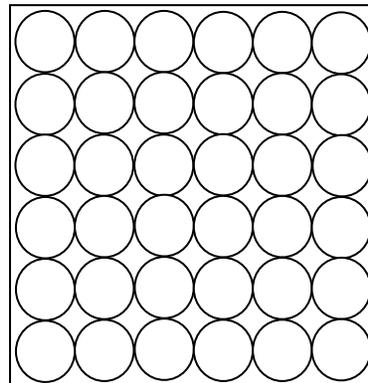
*Draw innerduct location in conduit & indicate labeling. Use page 2 of 2 if necessary

KEY PLAN OF MH/HH

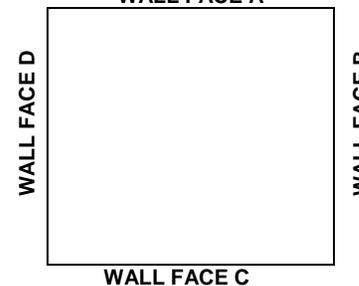
WALL FACE A



WALL FACE B



WALL FACE A

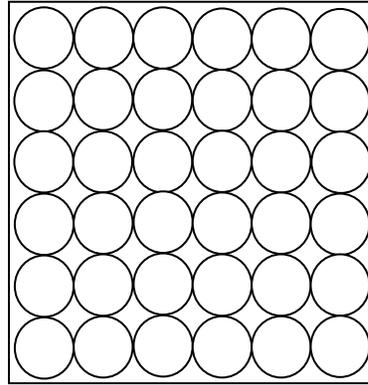
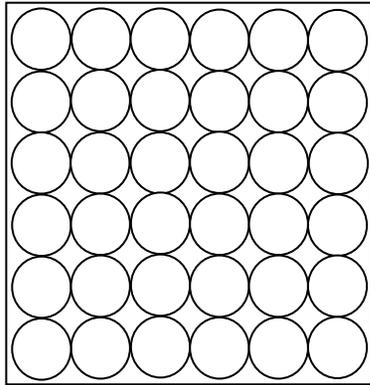


WALL FACE C

Note: Indicate in the Box, the Direction of the True North for Reference.

WALL FACE C

WALL FACE D



NOTES:

- | Y | N | N/A | MHs and HHs |
|--------------------------|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | | Existing MH / HH |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Fiber Loop per FAA detail |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Security Fiber looped per FAA detail |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | FAA FOTS Loop Tags present |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Tracer wire in place per plan |
| <input type="checkbox"/> | <input type="checkbox"/> | | Uniduct for tracer wire identified in Grey |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Saddle Racks / Rack Arms Installed |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Ground Rod Installed |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Pulling Eyes Grounded |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Frame Grounded |
| <input type="checkbox"/> | <input type="checkbox"/> | | Ground Bus Installed |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Mech Seal Installed in used Innerduct |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Tuckpoint Conduits |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | MH / HH Cleaned (New installation only) |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Pull strings installed (New MH & HH Only) |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Conduit Mandrelled |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Document cell used |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Innerduct installed / color (circle below) |
| | | | Yellow Grey Orange |

Ductbank Legend
 (to be filled in per Project)

 Name of Contractor F.M. Signature Date

 Name of OMP Inspector Signature Date

 Name of FAA Inspector Signature Date

Project Name: _____
 OMP Project No: _____
 Contractor: _____
 Electrical MH/HH No.: _____
 Electrical MH/HH Lid Label: _____

Date: _____
 Location: _____

Wall	Face	A	B	C	D	E	F	G	H	I	J	K	L
		<input type="checkbox"/>											
			<input type="checkbox"/>										
		<input type="checkbox"/>		<input type="checkbox"/>									

(Identify Cells as A1, B1, ...K6, L6, ...)

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description:

CELL No. _____

Contents Description:

CELL No. _____

Contents Description:

Name of Contractor F.M.

Signature

Date

Name of OMP Inspector

Signature

Date

Name of FAA Inspector

Signature

Date

EXCAVATION AND EMBANKMENT FOR FAA RELOCATIONS (SECTION P-152)

PART 66 DESCRIPTION

66.01 GENERAL

- A. This item covers excavation, disposal, placement, backfilling, and compaction of materials within the limits of the work required to construct the safety areas, runways, taxiways, aprons, pavements, and intermediate as well as other civil work areas in accordance with these Specifications and in conformity to the dimensions and typical sections shown on the Drawings or as directed by the Engineer and CDA.

66.02 RELATED DOCUMENTS

- A. Related special provisions include the following:
1. Topsoiling for FAA Relocations (Section T-905)
 2. Site Demolition for FAA Relocations (Section X-100)
 3. Quality Control Program for FAA Relocations (Section Q-100)
 4. Installation of Airport Underground Electrical Duct (Section L-110)
 5. Trench Backfilling for FAA Relocations (Section P-157)

66.03 CLASSIFICATION – EXCAVATION AND EMBANKMENT

- A. All excavated material will be classified as defined below:
1. Unclassified Excavation: Unclassified excavation will consist of the excavation, placement, and/or disposal of all material, regardless of its nature, which is not otherwise classified and paid for under other items. Unclassified Excavation includes the following:
 - a. Required Excavation: Excavation will consist of the excavation within the project limits required to achieve the grading depicted on the Drawings or as directed by the Engineer and CDA.
 - b. Borrow Excavation: Borrow Excavation will consist of excavation of approved material required for the construction of embankment or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material will be obtained from areas as shown on the Drawings or as directed by the Engineer and CDA.
 - c. Topsoil Stripping: Topsoil Stripping will consist of the stripping of topsoil material. Topsoil which cannot be placed in its final location will be stockpiled or disposed of as instructed by the Engineer and CDA. Stockpiles will be at the locations and to the heights and slopes approved by the Engineer and CDA. Section

P-156 requirements will apply to all stockpiles and all stockpiles will be included in this Work.

- d. **Excavation of Recyclable Material:** This refers to the excavation of any recyclable material such as large chunks of Portland cement concrete, large chunks of bituminous concrete, brick, metallic debris, or materials otherwise considered unsuitable for embankment construction with a maximum dimension exceeding two feet in any direction. These items must be delivered to the Recyclable Material stockpile area on the Airport as shown on the Drawings or as instructed by the Engineer and CDA, within five miles of the site for materials to be stockpiled or for recycling or disposal by others. Wood must be chipped and disposed of offsite or onsite at a location as directed by the Engineer and CDA.
 - e. **Unsuitable Material** is any material containing vegetable or organic matter, such as muck, peat, organic silt, topsoil, or sod and will be considered unsuitable for use in embankment construction. Such material, when approved by the Engineer and CDA as capable of supporting vegetation, may be used on embankment slopes.
2. **Unclassified Excavation – Contaminated Material:** Unclassified Excavation – Contaminated Material will consist of the excavations, on-site handling, and placement of non-hazardous contaminated materials; and the excavation and offsite disposal of hazardous waste and Non Aqueous Phase Liquids (NAPL). This also includes removal and disposal of underground storage tanks (UST), drums, and other containers with either regulated substances or contaminated materials inside.

Contaminated Material is any material which contains a regulated substance. A regulated substance is a hazardous substance, special waste, or petroleum or any fraction thereof, as those terms are defined in the Illinois Compiled Statutes.

State and local permitting requirements must be complied with prior to disturbing underground storage tanks (UST). The requirements include, but are not limited to, applying for regulatory permits, environmental sampling protocols, and site visits by the regulatory agencies to approve the removal of the tank.

If environmental studies of the work area have identified areas of contaminated soil, non-hazardous contaminated material may be stockpiled on the Airport as directed by the Engineer and CDA. If the Engineer and CDA directs the Contractor to dispose of the hazardous waste or NAPL offsite, the Contractor must document proper disposal of these soils at a licensed facility. Alternately, the Engineer and CDA may direct the disposal by others. Based on the data from the environmental studies, the

soils will be classified as non-hazardous contaminated materials, hazardous waste, or NAPL. Disposal must conform to Article XIV, Part Two, General Conditions of the CDA standard specifications.

- B. All embankment material will be classified as defined below:
1. Suitable Material: To be considered suitable for construction of subgrade and embankment areas for safety areas, runways, taxiways, aprons, pavements, building foundations, or service roadways, the material must meet the conditions described below:
 - a. Suitable material is unclassified excavation material that is non-organic, non-decayable, and non-rubble material having a maximum dry density of not less than 98 pounds per cubic foot. It will contain no rock, stones, or broken concrete greater than four (4) inches in the largest dimension in the top twelve (12) inches of the proposed subgrade; no greater than nine (9) inches in the largest dimension within one (1) foot to four (4) feet below the finished subgrade; and no greater than twenty (20) inches in the largest dimension below four (4) feet of the finished subgrade. The material must be easily compactable to the required density and approved by the Engineer and CDA. Compaction requirements for suitable material are provided in Table 1.

In addition, the top 1.5 feet minimum of embankments under all pavement areas must be an impervious cohesive soil, uncontaminated by deicing salts, chemical waste, sewage, or disposal wastes of any kind, with the following properties:

The material will not possess an organic content greater than five percent when tested in accordance with AASHTO T-194.

The material must have:

 - 40% or more passing No. 200 sieve.
 - A plasticity index between 12% and 25%.
 - A liquid limit between 25% and 50%.
 2. Restricted Material: Material with deviations from the above requirements for suitable material is restricted to use for construction of embankments in areas outside of the runway or taxiway safety areas, apron pavements, service roadways, or building footprints if acceptable to the Engineer and CDA. The Engineer and CDA will be the sole judge of the suitability of all materials whether taken from required excavations, on-site stockpiles, or off-site borrow sources. Compaction requirements for restricted material are provided in Table 1.
 3. Unsuitable Material: Material as defined in Section 1.03.A.1.e is not

suitable for embankment construction.

66.04 SUBMITTALS

- A. Work Plan – The Contractor must submit a work plan to the Engineer and CDA for approval prior to beginning the excavation and embankment work. The Work Plan must include:
1. Excavation of materials and direct placement, excavation of materials and stockpiling in temporary stockpile areas and placement, and excavation and placement of excess materials to the stockpile areas shown on Drawings or as directed by the Engineer and CDA.
 2. The plan must provide for multiple work areas within the Project area for performing Work such that there will always be work areas available if certain areas are shut down or are unavailable to the Contractor for any reason.
 3. The plan must include clearing and grubbing tasks, seeding and mulching, and erosion control in accordance with the Erosion Control Plan.
 4. List of equipment to be used for excavation, hauling, compaction, disking, and testing.
 5. Sequence of excavation and placement and schedule in compliance with Contract requirements.
 6. Quality Control testing plan and independent testing laboratory experience for performing quality control testing as established in the requirements of Section Q-100, "Contractor Quality Control Program", of these Specifications.
 7. Procedures for constructing, maintaining, and removing haul roads, including signage as required in Section 01502, "Traffic Control".

PART 67 CONSTRUCTION METHODS

67.01 GENERAL

- A. The Contractor must inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. The Engineer and CDA will make final determination of classification of all excavated material. No payment will be made for any excavated material which is used for purposes other than those designated. Before beginning excavation, grading and embankment operations in any area, the area must be completely cleared and grubbed and stripped of topsoil. Erosion control measures and materials must be installed prior to land disturbing activities in accordance with the Contractor's approved Erosion Control Plan as accepted by the Engineer and CDA and in accordance with Section P-156.
- B. The suitability of material to be placed in embankments must be acceptable to the Engineer and CDA. All Unsuitable Material must be disposed of at Contractor's expense in waste areas on the Airport as directed by the Engineer and CDA. All hazardous waste and NAPL must be disposed of in a licensed disposal site in accordance with Article XIV of the General Conditions of the CDA

standard specifications. All waste areas on the Airport, if so designated, will be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of waste areas will not extend above the surface elevation of adjacent usable areas of the Airport, unless specified on the Drawings or approved by the Engineer and CDA.

- C. Recyclable Material and all other materials not considered suitable for use elsewhere must be disposed of in designated areas for recycling and disposal by others as directed by the Engineer and CDA. In no case will any discarded materials be left in windrows or piles adjacent to or within the Airport limits. The manner and location of disposal of materials will be subject to the acceptance of the Engineer and CDA and must not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the Airport property limits at its own expense, the Contractor must obtain and file with the Engineer and CDA, permission in writing from the property owner for the use of private property for this purpose.
- D. Blasting will not be allowed.
- E. If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor will be responsible for and must take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor must notify the Engineer and CDA, who will arrange for their removal if necessary. The Contractor must, at its own expense, satisfactorily repair or pay the cost of all damage to such facilities or structures which may result from any of the Contractor's operations during the period of the Contract.
- F. When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations must be temporarily discontinued. At the direction of the Engineer and CDA, the Contractor must excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.
- G. Those areas outside of the pavement areas in which the top layer of soil material has become compacted, by hauling or other activities of the Contractor, must be scarified and disked to a depth of 4 inches, in order to loosen and pulverize the soil.
- H. The excavation must be carried out to the required lines and grades shown on the Drawings unless the Engineer and CDA authorizes over-excavation to remove unsuitable materials. Should the Contractor, through negligence or other fault, excavate below the designated lines, it must replace the excavation with approved materials, in an acceptable manner and condition, at its own expense.
- I. The Contractor must repair eroded areas and take all measures to prevent continued erosion immediately and/or as indicated by the Engineer and CDA. No separate payment will be made for this Work.
- J. The Contractor must sort, separate, and remove all logs and wood material encountered in excavated material with a maximum dimension exceeding 2 feet in any direction. The Contractor must chip this wood material and dispose of

offsite. No separate payment will be made for this Work.

67.02 EXCAVATION

- A. No excavation will be started until the work has been staked out and cross sectioned by the Contractor and the Engineer and CDA has received, reviewed, and concurred with the elevations and measurements of the ground surface. All Suitable Material must be used in the formation of embankment, subgrade, or for other purposes shown on the Drawings. Excess Suitable Material will be disposed of as shown on the Drawings or as directed by the Engineer and CDA. All Unsuitable Material must be disposed of as shown on the Drawings or as directed by the Engineer and CDA.
- B. When the Contractor encounters an area of suspected contaminated material, any container with suspect contents inside, and/or underground storage tank (UST), the Engineer and CDA must be notified immediately prior to any further work in the general vicinity. The area must be marked and delineated with safety fencing to alarm personnel of potential hazard in the area. The Engineer and CDA will perform tests as necessary to determine the degree of contamination and the limits of material to be removed and disposed of as Unclassified Excavation-Contaminated Material. At the direction of the Engineer and CDA, the Contractor, at no expense to the City, must redirect its labor and equipment to other work areas until the City's environmental consultant can evaluate the types and levels of contamination. Test results will be furnished to the Contractor for his use in securing the necessary permits and licenses for disposal. The Contractor must be responsible for any additional testing required in obtaining permits for hauling and disposal of the Contaminated Material.

Based on the results from the Engineer and CDA's environmental consultant's assessment, the Engineer and CDA will direct the Contractor as follows:

- 1. **Material Can Remain on Site:** The Engineer will issue the Contractor a Field Order to proceed with the excavation and placement on site. Should the Engineer and CDA's direction require the Contractor to perform work beyond the effort necessary to comply with Contract requirements, the City will compensate the Contractor for eligible costs.
 - 2. **Material Must be Transported by the Contractor to a Licensed Disposal Facility:** If the contractor has the resources to properly manage this material, the Engineer may issue the Contractor a Field Order to handle and transport the material to a licensed disposal facility.
 - 3. **Material Must be Transported by a Third Party Contractor to a Licensed Disposal Facility:** The Engineer reserves the right to use a third party Contractor for managing this type of soil. If the Engineer selects this option, the Contractor will not be eligible for any additional compensation as a result of the third party Contractor's work. For any soil removed by a third party Contractor, the City will deduct the volume of this soil from the Contractor's appropriate P-152 Pay Item quantity.
- C. When the volume of the required excavation exceeds that required to construct the embankments to the grades indicated, the excess will be used to grade the

areas of ultimate development or disposed of as directed by the Engineer and CDA.

- D. When the volume of required excavation is not sufficient for that required to contrast the embankments to the grades indicated, the deficiency will be obtained from borrow areas. Borrow must be obtained from sources as shown on the Drawings or as directed by the Engineer and CDA. The Contractor must notify the Engineer and CDA at least 15 days prior to beginning the excavation, so necessary measurements and tests can be made. All borrow pits must be opened up to expose the vertical face of various strata of acceptable material to enable obtaining a uniform product. Borrow pits must be excavated to regular lines to permit accurate measurements, and they must be drained and left in a neat, presentable condition with all slopes dressed uniformly.
- E. The grade must be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches must be installed to intercept or divert surface water which may affect the work.
- F. The subgrade must be inspected by proof-rolling in embankment areas, after surface stripping, and in cut areas after excavating to the required subgrade level. The subgrade must be proof-rolled with a 25 ton (or heavier) pneumatic tired roller making at least 8 passes over the entire area in alternate (perpendicular) directions or a fully loaded semitruck loaded to the legal limit at the Engineer and CDA's discretion. Any continuously yielding or unstable area, as determined by the Engineer and CDA, must be undercut and backfilled in accordance with the undercutting requirements below. The final lift of embankment must be proof rolled under pavement areas.
- G. When Selective Grading is indicated on the Drawings or Specifications, the more suitable material as designated by the Engineer and CDA must be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it must be stockpiled in approved areas for later use.
- H. The Contractor is advised that it must classify and sort all materials encountered according to the requirements of Section P-152. Attention is called to the Drawings, soil borings, Geotechnical Report, and other Contract Documents. The Contractor may need to modify its excavation methods and operations in order to sort, embank, and stockpile materials accordingly. The Contractor must adhere to the requirements of Section Q-100 and employ qualified Quality Control technicians on a full-time basis to accomplish this task. The Engineer and CDA will make the final determination of classification of excavated material. The suitability of material to be placed in embankments or stockpiles must be acceptable to the Engineer and CDA.
- I. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for runway safety areas, subgrades, roads, shoulders, or any areas intended for turfing must be excavated to a minimum depth of 12 inches, or to the depth specified by the Engineer and CDA, below the subgrade or designated grade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation as determined by the Engineer and CDA, must be removed to the

depth specified by the Engineer and CDA and backfilled with either Suitable Material or with Stabilization Stone CA-1, as directed by the Engineer and CDA, in accordance with Section P-152 and/or the requirements for undercut and backfill of Section P-154, Frost Protection Course. Any failures of proof rolls on the final lift of embankment placed by the Contractor under pavement areas, will be undercut or corrected by the Contractor to the satisfaction of the Engineer and CDA at no cost to the Engineer and CDA.

- J. Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as shown on the plan or authorized by the Engineer and CDA. All overbreak must be graded or removed by the Contractor and disposed of as directed; however, payment will not be made for the removal and disposal of overbreak. Unavoidable overbreak as determined by the Engineer and CDA, will be classified as "Unclassified Excavation".

67.03 EMBANKMENT

- A. Compaction Requirements: Refer to Table 1 for subgrade compaction requirements in Sections under proposed pavements and Sections outside pavement areas.
1. The Engineer and CDA will make the determination as to cohesive and non-cohesive soil in regards to selecting the proper type of equipment required to compact the material.
 2. When the level of compaction of in-situ soils reaches the specified level of compaction, no further removal, manipulation and recompaction is necessary.
 3. Further removal, manipulation and recompaction necessary to obtain the required field density will not be paid separately, but considered included in the Unclassified Excavation.
 4. The in-place field density will be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 6938. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in top 6 inches of the subgrade. The finished grading operations, conforming to the typical cross section, must be completed and maintained at least 1,000 feet ahead of the paving operations or as directed by the Engineer and CDA.
 5. In cuts, all loose or protruding rocks on the back slopes must be bared loose or otherwise removed to line of finished grade of slope. All cut-and-fill slopes must be uniformly dressed to the slope, cross section, and alignment shown on the Drawings or as directed by the Engineer.

TABLE 1
 Soil Compaction Requirements
Percent of Maximum Density as Determined by ASTM D-1557

	Beneath Rigid Pavement¹		Beneath Flexible Pavement²		Outside Pavement Area	
	Cohesive Soils	Noncohesive Soils³	Cohesive Soils	Noncohesive Soils³	Cohesive Soils	Noncohesive Soils
Cut sections (compaction of subgrade)	<ul style="list-style-type: none"> • Top 6 inches of subgrade - 90% 	<ul style="list-style-type: none"> • Top 6 inches of subgrade - 100% • Next 18 inches - 95% 	<ul style="list-style-type: none"> • Top 9 inches of subgrade - 95% • 9 to 18 inches below top of subgrade - 90% • 18 to 27 inches below top of subgrade - 85% • 27 to 36 inches below top of subgrade - 80% 	<ul style="list-style-type: none"> • Top 23 inches of subgrade - 100% • 23 to 41 inches below top of subgrade - 95% • 41 to 59 inches below top of subgrade - 90% • 59 to 76 inches below top of subgrade - 85% 		

TABLE 1
 Soil Compaction Requirements
Percent of Maximum Density as Determined by ASTM D-1557

	Beneath Rigid Pavement¹		Beneath Flexible Pavement²		Outside Pavement Area	
	Cohesive Soils	Noncohesive Soils³	Cohesive Soils	Noncohesive Soils³	Cohesive Soils	Noncohesive Soils
Fill sections (including existing subgrade if fill thickness is less than 36 inches for cohesive soils and 76 inches for noncohesive soils)	<ul style="list-style-type: none"> Entire fill section - 90% Top 6 inches of existing soil - 90% 	<ul style="list-style-type: none"> Top 6 inches of fill - 100% Remaining depth of fill - 95% Top 6 inches of existing soil - 90% 	<ul style="list-style-type: none"> Top 9 inches of fill - 95% 9 to 18 inches below top of fill - 90% 18 to 27 inches below top of fill - 85% 27 to 36 inches depth and below - 80% (including top 6 inches of existing soil if fill thickness is greater than 36 inches) 	<ul style="list-style-type: none"> Top 23 inches of fill - 100% 23 to 41 inches below top of fill - 95% 41 to 59 inches below top of fill - 90% 59 to 76 inches below top of fill - 85% 76 inch depth and below - 80% (including top 6 inches of existing soil if fill thickness is greater than 76 inches) 	<ul style="list-style-type: none"> Entire fill section - 90% 	Entire fill section - 95%

TABLE 1
 Soil Compaction Requirements
Percent of Maximum Density as Determined by ASTM D-1557

Beneath Rigid Pavement¹		Beneath Flexible Pavement²		Outside Pavement Area	
Cohesive Soils	Noncohesive Soils³	Cohesive Soils	Noncohesive Soils³	Cohesive Soils	Noncohesive Soils

¹Rigid pavements consist of Portland Cement Concrete placed upon a granular or treated subbase course over compacted subgrade. Rigid pavements may have bituminous overlays.

²Flexible pavements consist of a bituminous wearing surface placed on a base course and possibly a subbase over a compacted subgrade. The base course may consist of bituminous base, crushed aggregate base or cement treated base course.

³For those soils having a plasticity index (P.I.) of greater than or equal to 4 or less than 6 and other borderline soils, the Engineer and CDA will determine the soil classification for the purpose of determining soil compaction requirements and compaction equipment (see 2.08.A). The Engineer and CDA will determine the type of compaction equipment under 2.08.A. Non-cohesive soils for purposes of determining compaction are those soils having a plasticity index (P.I.) of less than 6.0.

- B. Where an embankment is to be constructed, all topsoil, sod, and vegetable matter must be removed from the surface upon which the embankment is to be placed, and the cleared surface must be completely broken up by plowing or scarifying to a minimum depth of 6 inches. This area must then be compacted as required by this Specification.
- C. Where embankments are to be placed on natural slopes steeper than 3 to 1 (H:V), or against cut slopes, horizontal benches 2 to 3 feet wide must be cut into the slope or constructed as directed by the Engineer and CDA.
- D. No direct payment will be made for the preparation work performed under this Section. No separate payment will be made for benching. This work will be considered included in the Contract unit price for Unclassified Excavation.
- E. Embankments will be formed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section, unless otherwise directed by the Engineer and CDA.
- F. The grading operations must be conducted, and the various soil strata must be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as topsoil, brush, hedge, roots, stumps, grass and other organic matter will not be incorporated or buried in the embankment. All

materials used in the formation of embankments under the pavement will be Suitable Material.

- G. Operations on earthwork must be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory conditions of the field. The Contractor must drag, blade, or slope the embankment to provide proper surface drainage if operations are suspended.
- H. The material in the layers must be within +/- 2 percent of optimum moisture content as determined by ASTM D 1557 before rolling to obtain the prescribed compaction. In order to achieve uniform moisture content throughout the layer, wetting or drying of the material and manipulation must be required when necessary. Should the material be too wet to permit proper compaction or rolling, all Work on all of the affected portions of the embankment must be delayed until the material has dried to the required moisture content. The material may be disked to a depth of 8 inches to hasten drying and then be recompacted to the requirements listed in Table 1. Sprinkling of dry material to obtain the proper moisture content must be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water must be available at all times. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken for each 250 cubic yards or in a 100 ft x 100 ft grid of material placed per layer, or as required by the Engineer and CDA. Based on these tests, the Contractor must make the necessary corrections and adjustments in methods, materials or moisture content in order to achieve the correct embankment density. The Contractor must at a minimum perform one modified proctor ASTM D1557 for each 10,000 cy of material placed or when materials change substantially as determined by the Engineer and CDA.
- I. Wet soils are defined as those soils whose moisture content, when placed in an embankment, exceeds the optimum moisture content necessary for compaction in accordance with this Specification. Embankment layers that are determined to be wet as a result of the moisture content of the in-situ excavation will be subject to the requirements below. No separate payment will be made for drying by any means of embankment layers that become wet as the result of the Contractor's failure to properly control surface drainage during construction. If wet soils are encountered during embankment construction or subgrade preparation, the Contractor, at a minimum, must take the following steps in an effort to obtain the moisture content needed to achieve the specified level of compaction:
 - 1. If the moisture is within 4% of the optimum moisture for the soil, the Contractor must air dry the uncompacted layer. The Contractor must disc, till or use whatever means appropriate to process the full depth of the uncompacted layer each day for three (3) consecutive good drying days. The Contractor must periodically check the moisture content during processing. As soon as acceptable moisture contents are achieved, the Contractor must acceptably complete the compaction of that layer.
 - 2. If, in the opinion of the Engineer and CDA, the specified level of compaction or moisture content cannot be obtained after air drying or the in situ moisture level at the time of excavation is excessive, Lime

Modification in accordance with Specification P-159, Lime Modified Soil may be authorized by the Engineer and CDA in writing. The quantity of lime approved for modification of the soil layer will be determined by the moisture content of that soil layer and by the type of the soil. Lime modified soil layers will be accepted based on the compaction and testing requirements of this Specification. The Engineer and CDA has the sole discretion in the use of lime for the purpose of modifying soils in order to achieve the specified level of compaction.

- J. Compacting operations must be continued until the embankment is compacted to the requirements listed in Table 1.
- K. On all areas outside of the pavement area, no compaction will be required on the top 4 inches.
- L. The in-place field density must be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 6938.
- M. Compaction areas must be kept separate, and no layer will be covered by another until the proper density is obtained.
- N. During construction of the embankment, the Contractor must route its equipment at all times, both when loaded and when empty, over the layers as they are placed and must distribute the travel evenly over the entire width of the embankment. The equipment must be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material must be broken up into small particles and become incorporated with the other material in the layer.
- O. In the construction of embankments, layer placement must begin in the deepest portion of the fill; as placement progresses, layers must be constructed approximately parallel to the finished pavement grade line.
 - 1. In embankments greater than 10 feet, sands, silts, silty sands, and sandy silts shall be placed in the lower portion of the embankment as directed by the Engineer and CDA.
- P. The final lift of embankment must be proof rolled under pavement areas. Any failures of proof roll on the final lift of embankment under pavement areas will be undercut or corrected by the Contractor to the satisfaction of the Engineer and CDA at no cost to the Engineer and CDA.
 - 1. Sands, silts, silty sands, and sandy silts should not be placed in the top 5 feet of embankment.
- Q. When rock and other embankment material are excavated at approximately the same time, the rock must be incorporated into the outer portion of the embankment and the other material must be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches in their greatest dimensions will not be allowed in the top 6 inches of the subgrade. Rockfill must be brought up in layers as specified or as directed and every effort must be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders must not be disposed of outside the excavation or embankment areas, except at places and in the manner designated by the Engineer and CDA.

- R. When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment, as directed by the Engineer and CDA, in layers not exceeding 2 feet in thickness. Each layer must be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of rock. These type lifts must not be constructed above an elevation 4 feet below the finished subgrade. Density requirements will not apply to portions of embankments constructed of materials which cannot be tested in accordance with specified methods.
- S. Frozen materials must not be placed in the embankment nor will embankment be placed upon frozen material.
- T. There will be no separate measurement for payment for compacted embankment, and all costs of placing in layers, compacting, diskings, watering, mixing, sloping, and other necessary operations for construction of embankments will be included in the Contract price for Unclassified Excavation.
- U. No additional payment will be considered for material excavated, stockpiled, and rehandled. The work required to rehandle stockpiled material will be considered included in the Contract unit price for Unclassified Excavation.
- V. Any embankment in paving areas placed in the previous year must be recompacted to the requirements of Table 1 for the top 8 inches and re-approved before paving. This requirement will consist of diskings, recompacting, and proof-rolling the embankment surface in accordance with the Specifications. No additional payment will be made for this Work.

67.04 FINISHING AND PROTECTION OF SUBGRADE

- A. After the subgrade has been substantially completed, the full width must be conditioned by removing any soft or other unstable material which will not compact properly. The resulting areas and all other low areas, holes, or depressions must be brought to grade with suitable select material. Scarifying, blading, rolling, and other methods must be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the Drawings.
- B. Grading of the subgrade must be performed so that it will drain readily. The Contractor must limit hauling over the finished subgrade to that which is essential for construction purposes.
- C. All ruts or rough places that develop in a completed subgrade must be smoothed and recompacted.
- D. No subbase, or other paving course will be placed on the subgrade until the subgrade has been accepted by the Engineer and CDA. Any damage to the accepted subgrade due to the Contractor must be repaired to the satisfaction of the Engineer and CDA by the Contractor at the Contractor's expense.

67.05 HAUL

- A. All hauling will be considered a necessary part of the work. Its cost must be considered by the Contractor and included in the Contract unit price for the pay

of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

67.06 EQUIPMENT

- A. The Contractor may use any type of earth moving, compaction, and watering equipment it may desire or has at its disposal, provided that the equipment is in satisfactory condition and is of sufficient capacity to perform the Work as specified. The only requirements specified are that tamping rollers (generally referred to as Sheepsfoot Rollers) will be considered the proper type of equipment for compaction of cohesive soils and vibratory/mechanical tamping equipment will be applicable for compacting granular soils. Subgrade rollers can be used to smooth minor surface deviations in both types of subgrade/embankment, but in no case will a steel wheel or vibratory roller be used to compact cohesive embankment. In all cases, the adequacy of the equipment will be determined by the Engineer and CDA. Failure to obtain the specified results, or failure to meet the schedule planned by the Contractor and acceptable to the Engineer and CDA, due to inadequate equipment will not be cause for delay or additional payment. The Contractor must furnish, operate, and maintain such equipment as is necessary to control density, section, and smoothness of grade.
- B. The requirements of Section 01111, Construction Air Quality – Diesel Vehicle Emissions apply to this Specification Section.

67.07 TOLERANCES

- A. In those areas upon which a subbase or base course is to be placed, the top of the subgrade must be of such smoothness that, when tested with a 16-foot straightedge applied parallel and at right angles to the centerline, it must not show any deviation in excess of ½-inch, or must not be more than 0.05-foot from true grade as established by grade hubs or pins. Any deviation in excess of these amounts must be corrected by loosening, adding, or removing materials; reshaping; and recompacting by sprinkling and rolling.
- B. On safety areas, intermediate and other designated areas, the surface must be of such smoothness that it will not vary more than 0.10 foot from true grade as established by grade hubs. Any deviation in excess of this amount must be corrected by loosening, adding or removing materials, and reshaping.

67.08 TOPSOIL

- A. When topsoil is specified or required as shown on the Drawings or under Item T-905, it must be salvaged from stripping or other grading operations. The topsoil must meet the requirements of Section T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its proper and final section of finished construction, the material must be stockpiled at approved locations. Stockpiles must not be placed within 50 feet of pavement or areas and must not be placed on areas which subsequently will require any excavation or embankment.
- B. Upon completion of grading operations, stockpiled topsoil must be handled and placed as directed, or as required in Section T-905. No stockpiles will be allowed to remain at the end of the Project.

- C. No separate payment will be made for topsoil as such under Section P-152. The quantity removed and placed directly or stockpiles is included in the Contract unit price for the Pay Item "Unclassified Excavation".

67.09 BACKFILLING OF REMOVAL ITEMS

- A. Any items removed as part of site demolition that lie in the proposed pavement or shoulder areas must be backfilled with FA-6 or CA-6 and mechanically compacted with vibratory equipment in accordance with Section X-100 as directed by the Engineer and CDA.

PART 68 METHOD OF MEASUREMENT

68.01 N/A

- A. BASIS OF PAYMENT

68.02 GENERAL

Payment for excavation will be included in the Contract unit price for the following items; handholes, ductbank, MALSR and ALSF-2 Approach Lights.

TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SEDIMENT CONTROL FOR FAA RELOCATIONS (SECTION P-156)

PART 69 DESCRIPTION

69.01 GENERAL

- A. This item consists of temporary control measures as shown on the Plans or as ordered by the Engineer and CDA during the life of a Contract to control water pollution, soil erosion, and sediment control through the use of aggregate berms, earth berms, temporary ditches, ditch and watercourse checks, sediment traps, sediment logs, erosion control blankets, stone, temporary seeding, inlet and pipe protection, and other erosion control devices or methods.
- B. The Contractor must control soil erosion in accordance with the provisions of NPDES permit issued by the Illinois Environmental Protection Agency (IEPA) for stormwater discharges from construction site activities.
- C. The Contractor must meet the Specifications of the Illinois Urban Manual (latest edition, published by IEPA and Illinois Natural Resources Conservation Service), as modified in the Contract Drawings and Specifications.
- D. The Contractor must coordinate temporary erosion control measures with the permanent erosion control measures to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

- E. Temporary erosion control is not limited to areas within the construction limits; construction operations at sites such as borrow pits, equipment and material storage sites, waste areas, temporary stock piles, temporary plant sites, and others are also subject to erosion control requirements.
- F. The best way to prevent sediment from entering storm sewer systems and waterways is to stabilize the disturbed areas of a site as quickly as possible, preventing erosion and stopping sediment transport at its source.
- G. Prior to commencing land disturbing activities other than those indicated on the Plans (including but not limited to additional phases of the development and off-site borrow, waste, asphalt and/or concrete batch plant areas) a supplemental erosion and sediment control plan must be submitted to the Engineer and CDA for review and approval by North Cook County Soil and Water Conservation District (NCCSWCD).

69.02 REFERENCES

- A. Illinois Department of Transportation - Standard Specifications for Road and Bridge Construction, latest edition (SSRBC).
- B. Illinois Urban Manual: A Technical Manual for Urban Ecosystem Protection and Enhancement, latest edition. United States Department of Agriculture, Natural Resources Conservation Service, Champaign, Illinois.
- C. Soil Erosion and Sediment Control Plan for the O'Hare Modernization Program.

69.03 DEFINITIONS

- A. Channels: All ditches and watercourses will be considered "channels."

69.04 SUBMITTALS

Contractor to submit Product Data – catalogs, brochures, and performance and test data to support conformance with the Specifications for the materials to include but not limited to:

- A. Temporary Seed – Signed statement by Vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing, within 6 months of delivery. Statement must include: name and address of laboratory, date of test, lot numbers for each kind of seed, results of the tests as to seed name, percentages of purity, and of germination, and in case of mixture, the proportion of each kind of seed.
- B. Mulch
- C. Erosion Control Blanket
- D. Fertilizer
- E. Silt Fence and Stakes
- F. Sediment Log and Stakes
- G. Sediment Containment Filter Bag
- H. Inlet Protection

- I. Polymer (Power form)
- J. Polymer (Floc Log form)
- K. Geotextile Fabric
- L. Jute Netting
- M. Temporary Stream Crossing – Aggregates, pipe, and installation drawing
- N. Concrete Washout Facility – 30 mil polyethylene liner
- O. Aggregates – Gradation test for each size of aggregate by a certified testing laboratory.

PART 70 MATERIALS

70.01 SEEDING, TEMPORARY

- A. Temporary Protection by Vegetation.
 - 1. Seed:
 - a. For disturbed areas that will not be in the active work area between 14 days and 365 days, seed must be applied at the following rates:
 - 1) Seed with 90 lbs. per acre of cereal rye and 25 lbs. per acre of perennial ryegrass, or
 - 2) Seed with 90 lbs. per acre of spring oats and 25 lbs. per acre of perennial ryegrass.

Mixture	Temporary Grass Seed Mixture	Lbs/acre (pure live seed)
1	Cereal rye	90
	Perennial ryegrass	25
2	Spring Oats	90
	Perennial ryegrass	25

70.02 MULCH

- A. Mulches must not consist of hay, straw, bark, or woodchips. Mulch may be hydromulch, polymer, or other suitable material approved by the Engineer and CDA that is reasonably clean and free of noxious weeds and deleterious materials.

70.03 EROSION CONTROL BLANKET

- A. Erosion Control Blanket must consist of a machine produced mat of straw fiber and must be furnished in rolls that meet the following requirements. Acceptable manufacturers include North American Green, Enviroscope ECM, Ltd., and U.S. Construction Fabrics LLC.
- B. The appropriate type of Erosion Control Blanket (short term or long term) must be installed as shown on the Drawings.
- C. Slopes 4 to 1 or greater, channels, ditches, swales, conveyances, flow lines, and other areas of concentrated flow that may be subject to erosion, must be stabilized with Erosion Control Blanket as shown on the Drawings and as required below.
 - 1. Slopes greater than 4 to 1 and all channels, swales, conveyances, flow lines, etc., must be stabilized at a minimum with a double net erosion control blanket that meets a maximum shear stress of 1.5 lbs/ft² and a minimum tensile strength of 50 lbs/ft.
 - 2. Slopes of 4 to 1 must be stabilized at a minimum with a single net erosion control blanket that meets a maximum shear stress of 0.5 lbs/ft² and a minimum tensile strength of 5 lbs/ft.
 - 3. Slopes less than 4 to 1 do not require erosion control blanket unless indicated on the Drawings, in which case, a single net erosion control blanket that meets a maximum shear stress of 0.5 lbs/ft² and a minimum tensile strength of 5 lbs/ft. shall be used.
- D. "U" shaped staples must consist of 0.12 inch diameter (No. 11 wire gage) or greater, with a minimum leg length of 6 inches and a minimum width of 1 inch and must be used to anchor the Erosion Control Blanket. In sandy soils, the minimum leg length of the staples must be 9 inches. Push pins or circle top pins are acceptable and must meet the material specifications stated above.

70.04 FERTILIZER

- A. Fertilizer must meet the Specifications of Section T-901, Seeding. Fertilizer must be a standard commercial grade and must conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

70.05 SILT FENCE

- A. Materials for silt fence must be in accordance with the detail Drawings. Filter fabric for the silt fence must meet the Illinois Urban Manual material Specification 592 or as indicated on the Drawings.

70.06 COARSE AGGREGATE AND RIPRAP

- A. Coarse Aggregate and Riprap material (for Rock Check Dam, Aggregate Berm, Riprap, Inlet and Pipe Protection, Construction Entrances, or other erosion control functions) used for erosion control must meet the requirements of IDOT SSRBC. Coarse Aggregate and Riprap for erosion control must be crushed/broken recycled concrete or crushed stone. Coarse Aggregate must

consist of CA-1, CA-2, CA-3 or CA-4 as indicated on the Drawings; and Riprap must consist of Gradation No. RR3 or RR 4; and geotextile fabric must meet the requirements of the Illinois Urban Manual material Specification 592, unless otherwise directed by the Engineer and CDA.

70.07 SEDIMENT LOG AND GEOSYNTHETIC CHECK STRUCTURE

- A. Material for Sediment Logs must be either American Excelsior Company standard 12-inch diameter Curlex Sediment Log, North American Green Straw Wattle, Western Excelsior Excel Aspen Excelsior Logs or similar 12-inch diameter (minimum) and as approved by the Engineer and CDA.
- B. Material for Geosynthetic check structure must be rigid or foam pad wrapped with geosynthetic fabric material meeting requirements of the Illinois Urban Manual material Specification 592. Fabric material must be stapled in a 3 to 6 inch trench on the upstream end and securely stapled to the ground on both sides of the check structure.

70.08 SEDIMENT CONTAINMENT FILTER BAG

- A. Sediment Control Filter Bags must be ACF Environmental ERO-TEX dewatering filter bag, US Fabrics filter bag, or JMD Enviro-Protection filter bag as approved by the Engineer and CDA, of the size required to adequately filter pumped water per the manufacturers' specifications.

70.09 INLET PROTECTION AND PIPE (CULVERT) PROTECTION

- A. Material for Pipe Culvert Protection must be Coarse Aggregate (must meet the standards defined above for Coarse Aggregate and Riprap).
- B. Materials for Above Ground Inlet protection must be per manufacturer's specification, and as approved by the Engineer and CDA. Acceptable products for above ground inlet protection include the following:
 - 1. Dandy Bag, Curb Bag, and Dandy Pop by Dandy Products
 - 2. Sediguard Inlet Protection Device by Earth Support Systems
 - 3. Storm Drain Inlet Frame and Filter Assembly by Silt Saver Sediment Control Products
- C. Materials for Below Ground Inlet protection must be per manufacturer's specification, and as approved by the Engineer and CDA. Acceptable products for below ground inlet protection include the following:
 - 1. Catch-All Inlet Protector by Mar-Mac Manufacturing Co., Inc.
 - 2. Dandy Sack and Dandy Curb Sack by Dandy Product
 - 3. SedCatch Sediment Basket by SedCatch Environmental Products
- D. Inlet protection is only to be used as a filter for sheet flow or in conjunction with a sediment containment filter bag. Inlet protection is not to be used as a filter for dewatering directly to the structure.

70.10 SUMP PIT

- A. Materials for Sump Pit must be 2 inch Coarse Aggregate and a filter fabric, with a ¼ to ½ inch hardware cloth wire placed around the standpipe prior to attaching the filter fabric, as shown and described in the CDA Standard Detail No. 7-03-02E.

70.11 POLYMER

- A. The polymer must be a water-soluble anionic polyacrylamide (PAM) used to minimize soil erosion, bind soil particles, remove suspended particles, and act as a construction aide. All site-specific soils must be tested by a Certified Professional in Erosion and Sediment Control (CPESC) each time a PAM is used. The polymer must be used in accordance with manufacturer's guidelines and as approved by the Engineer and CDA.
- B. Anionic PAM mixture must have $\leq 0.05\%$ free acrylamide monomer by weight as established by the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA).
- C. The PAM mixture must be accompanied by manufacturers written instructions to ensure proper (1) Product and Site Preparation, (2) Application, (3) Maintenance/Re-application, (4) Storage, and (5) Safety, in accordance with Occupational Health and Safety Administration (OSHA) material safety data sheet (MSDS) requirements and other applicable guidelines including manufacturer's recommendations for specified use.
- D. Anionic PAM application must comply with all federal, state, and local laws, rules or regulations governing anionic PAM. The Contractor will be responsible for securing required permits.
- E. In addition to soil testing, a CPESC must design the installation plan for the polymers based on mix time and point of entry.
- F. The materials used must be harmless to plant and aquatic life.
- G. Different types of polymers may be required for each soil type or combination of soils. The manufacturer or supplier will provide general written application methods, based on site conditions, such as slope and soil type.

70.12 GEOTEXTILE FABRIC

- A. Geotextile fabric material must meet the requirements of the Illinois Urban Manual material Specification 592 – Geotextile as indicated on the detail Drawings.

70.13 JUTE NETTING

- A. Jute netting must be of a uniform, open, plain weave, undyed and unbleached single jut yarn. The yarn must be of loosely twisted construction and must not vary in thickness by more than one-half its normal diameter.
- B. Minimum width must be 48 inches, + or – 1 inch from manufacturer's rated width.
- C. Seventy-eight warp ends per 4 feet of width.

- D. Forty one weft ends per yard.
- E. Weight must average 1.22 lbs per linear yard with a tolerance of + or – 5%.
- F. The opening size for the weave must not be larger than $\frac{5}{8}$ " by $\frac{5}{8}$ ".
- G. Jute netting must be used in conjunction with polymer (PAM) as per CPESC and Engineer and CDA.

70.14 TEMPORARY CONCRETE WASHOUT FACILITY

- A. Install a device to control concrete wastes to prevent both on-site and off-site pollution. The device must be installed on any construction site where concrete is used.
- B. Temporary concrete washout facility must be in accordance with OMP Standard Detail No. 7-03-02II Barrier Type or 7-03-02JJ Earthen Type or 7-03-02KK Straw Bale Type.
- C. Temporary concrete washout facilities must be supplied in sufficient quantity and size to manage all liquid and solid wastes generated by washout operations.
- D. The walls of above grade facilities may be constructed of straw bales, barrier walls, or earthen berms. Straw bales and barrier walls must be butted tightly end-to-end. All types of concrete washout facilities must be lined with a 30-mil polyethylene liner free of holes and tears and must be secured using sandbags, 6" wire staples, or other anchors, as approved by the Engineer and CDA.

70.15 OTHER

- A. All other materials must meet commercial grade standards and must be approved by the Engineer and CDA before being incorporated into the Project.

PART 71 CONSTRUCTION METHODS

71.01 GENERAL

- A. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations must apply.

71.02 SCHEDULE

- A. Prior to the start of construction, the Contractor must submit schedules (timing for erosion control work to be performed relative to other construction items) for accomplishment of temporary and permanent erosion control work. The Contractor must also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work must not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Engineer and CDA and initial erosion control items have been properly installed.

71.03 AUTHORITY OF ENGINEER AND CDA

- A. The Engineer and CDA have the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, to limit the surface area of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment.

71.04 TEMPORARY RE-ROUTING OF CHANNELS

- A. Re-Routing Channels. All channels must continue to provide existing flow capacities until new stormwater conveyance and storage structures are constructed and fully operational. For construction practices that reduce channel capacity for longer than the working hours of one work day, the Contractor must re-route the channel, and allow at least the original flow capacity and in the case of regulated streams, according to the IDNR permit requirements. The channel must be replaced to original contours after construction, unless otherwise directed by the Plans or by the Engineer and CDA.
- B. Re-routed Channel Protection. Re-routed channels must be protected from erosion and sediment using Erosion Control Blanket (single or double net), Turf Reinforcement Mat (TRM), Geofabric, Temporary Seeding, Riprap, Sediment Log, Geosynthetic Check Structure, Aggregate Ditch Check, and as directed by the Engineer and CDA.

71.05 CHANNEL CHECKS

- A. All channels must be protected from erosion from surrounding construction zones. Channel checks must consist of Rock Check Dams, Aggregate Berms, Sediment Logs and others. Channel checks must be installed prior to disturbing land within their drainage areas; must be installed during the lowest reasonable flow conditions; and must be installed in a manner to minimize disturbance. The purpose of this practice is to reduce flow velocity and to pond water, thereby reducing active channel erosion and promoting settling of suspended solids.
- B. Sediment accumulated upstream of channel checks (including Rock Check Dams, Aggregate Berms, Sediment Logs, and others) must be removed when it reaches $\frac{1}{2}$ the height of the check spillway invert. Removed sediment must be deposited in an area previously approved by the Engineer and CDA. Sediment must not be placed in areas that contribute to sediment off-site or are not permanently stabilized.
- C. Remove and replace stone for Rock Check Dams and Aggregate Berms when the structures become plugged, silt laden, or as required by the Engineer and CDA.
- D. Rock Check Dams and Aggregate Berms. Rock Check Dams and Aggregate Berms in channels must be constructed from stone (coarse aggregate and riprap) as shown on the Drawings. Stone for Rock Check Dams and Aggregate Berms must be placed on the surfaces and to the depths specified. Stone must be placed in one operation and in such a manner to avoid serious displacement of the underlying materials. Stone must be delivered and placed in a manner to

ensure that the stone is reasonably homogeneous with the larger stones evenly distributed and firmly in contact with one another with smaller stones filling the voids between the larger stones.

1. Height. Rock Check Dams and Aggregate Berms must have a minimum height of 12 inches and a maximum height of 36 inches.
2. Spillway. Rock Check Dams and Aggregate Berms must be installed with sides 6 inches to 12 inches higher than the central spillway, forming a weir.
3. Dimensions. Rock Check Dams and Aggregate Berms must have a minimum top width of 2-feet measured in direction of flow with maximum side slopes of 2:1 (h:v).
4. Location. Rock Check Dams and Aggregate Berms must be placed and sized such that resultant ponding must not cause inconvenience or damage to adjacent areas, such as roads.
5. Stability. For additional stability in higher flow channels, Rock Check Dams and Aggregate Berms should be keyed into the soil to a depth of 6-inches.

Filter fabric used in Rock Check Dam must be in accordance with the Illinois Urban Manual material Specification 592 Geotextile, as shown on the Drawings, and it is included in the pay item Rock Check Dam. No additional payment will be made for filter fabric.

- E. Sediment Logs. Sediment logs must be installed according to the manufacturer's instructions, except as modified in the Contract Drawings and Specifications. Sediment logs must be keyed into the soil to a depth of two inches, unless otherwise directed by the Engineer and CDA.
- F. Geosynthetic Check Structure: Fabric material that covers rigid foam pad must be stapled in a 3 to 6 inch trench on the upstream end and securely stapled to the ground on both sides of the check structure. The center of the geosynthetic check structure must be 6 inches lower than the sides and secured (barrier and fabric) in the ground staples.

71.06 TEMPORARY STREAM CROSSING

- A. Whenever construction equipment must cross streams at frequent intervals, temporary stream crossing must be provided.
- B. As a minimum, structure must be designed to pass 2-year, 24-hour storm without overtopping and no erosion will result from the 10 year peak storm. In case of regulated streams, the Engineer and CDA will facilitate the permit application process through the IDNR-OWR. Temporary stream crossing must be designed and installed according to the IDNR permit requirements.
- C. Outlet of the crossing structure must be stabilized if the flow velocity can cause erosion for the receiving stream channel.
- D. The aggregate for the roadway must be a minimum of 6 inches thick stone meeting requirements of IDOT SSRBC.

71.07 STABILIZED CONSTRUCTION ENTRANCE / EXIT

- A. Construction entrance / exit must be used at all points of construction ingress and egress to the public road.
- B. The aggregate for the construction entrance / exit must meet the requirements of IDOT SSRBC and Geotextile Fabric must meet the requirements of the Illinois Urban Manual material Specification 592.
- C. Each construction entrance / exit must meet the following minimum dimensions: thickness of 6 inches, width of 14 feet; but not less than full width of ingress or egress point, and length of 70 feet. Filter fabric must be installed under aggregate to minimize the migration of the stone into the underlying soil.

71.08 DEWATERING

- A. Sump Pit. Pumping water from open trenches or other areas must be performed in a manner to minimize the turbidity of the pumped water in accordance with CDA Standard Detail No. 7-03-02E (Illinois Urban Manual IL-650). The pumping operation must start with the installation of the intake hose into the Sump Pit and then discharge directly into a sediment trap, stabilized ditch, temporary stabilized ditch that leads to a sediment trap, designed treatment channel, sediment containment filter bag, or another Best Management Practice (BMP) that is approved by the Engineer and CDA.
- B. Sediment Containment Filter Bag. When water cannot be pumped directly to a sediment trap, or site conditions call for use of an additional layer of erosion control, water must be pumped directly into a Sediment Containment Filter Bag. Sediment Containment Filter Bags must be used according to the manufacturer's instructions, as modified by the Contract Drawings and Specifications. Sediment Containment Filter Bag must be placed flat on a stabilized surface as shown in the Drawings.

71.09 TEMPORARY STOCKPILES

- A. Stockpile Sediment and Erosion Control. If a stockpile is to remain in place more than 3 days, perimeter barrier must be installed and "tracking" with machinery (tracking up and down the slope parallel to the direction of the slope, such that the track cleat marks are perpendicular to the direction of the slope in order to prevent the development of erosion rills/gullies) must be provided. If the construction activity temporarily or permanently ceased and construction activity will not occur for a period of 14 days, temporary stabilization must be provided for each stockpile by the 7th day after activity has ceased. If the stockpile is to remain inactive for more than 365 days, the stockpile must be permanently seeded per Contract Specifications. Stockpile sediment and erosion control can include Temporary Seeding, Permanent Seeding, Polymer, Silt Fence, Erosion Control Blanket, or other methods approved by the Engineer and CDA. Contractor must maintain the installed sediment and erosion control measures for the duration of the Project or until the Contractor's responsibilities for maintenance cease as determined by the Engineer and CDA.

71.10 SEDIMENT TRAPS and TEMPORARY DITCHES

- A. Sediment Trap: Sediment Traps are relatively effective at trapping medium to coarse-grained particles, and must meet the following Specifications:
1. Depth: Sediment trap must be a minimum of 2 feet measured from the sediment trap bottom to the invert of the stone outlet to provide sediment and detention storage.
 2. Shape: Sediment trap must have a length-width ratio of at least 2:1. Side slopes must be no steeper than 2:1 (h:v) and must be stabilized.
 3. The surface of the trap must be stabilized with Geotextile Fabric which meets the Illinois Urban Manual material Specification 592. The trap must be maintained and regularly cleaned of sediments to maintain its holding capacity. Any damaged fabric must be replaced or repaired.
 4. Outlet: The position of the outlet must be as such to minimize short-circuiting of the water flow path. The crest of the spillway must be at least 1 foot below the top of the embankment. The width of the rock check dam outlet must span the width of the outlet channel. The top of the rock check dam outlet must be constructed so that the center is approximately 6 inches lower than the outer edges. Discharge from the outlet must be to a stabilized area.
- B. Stone Outlet Structure for Sediment Trap
1. Riprap (RR-4) for Stone Outlet Structure must meet requirements of the Standard Specifications for Road and Bridge Construction (SSRBC).
 2. Geotextile Fabric must meet requirements of the Illinois Urban Manual material Specification 592.
 3. Cost of Geotextile Fabric is included in the pay item of stone outlet structure for sediment trap and no additional payment will be made.
- C. Temporary Ditch. Temporary Ditches must be constructed as shown on the Drawings or as directed by the Engineer and CDA to provide drainage paths to sediment traps. These ditches must have side slopes no steeper than 2:1 (h: v). The slopes of the temporary ditch must be stabilized with Temporary Seeding, Erosion Control Blanket, (single, double net or TRM), Geofabric, and/or Riprap as directed by the Engineer and CDA, before ditches convey flow.

71.11 INLET AND PIPE (CULVERT) PROTECTION

- A. All inlets to storm sewers that will potentially be affected by the Contractor's construction activities must be protected with Inlet and Pipe Protection barriers. Coarse Aggregate for culvert protection, above ground and below ground inlet protection meeting manufacturer's specification and as approved by the Engineer and CDA must be installed at the direction of the Engineer and CDA.
- B. Inlet protection must be constructed before upslope land disturbance begins and before the storm drain becomes operational.
- C. The inlet protection barriers must allow for overflow from a severe storm event.

71.12 SILT FENCE

- A. Silt Fence must be installed in accordance with the Illinois Urban Manual where erosion would occur in the form of sheet flow and there is no concentration of water flowing to the barrier. Silt Fence must be placed as close to the contour as possible with the ends extending upslope. The area below the fence if possible, must be undisturbed or stabilized. Fence posts must be a minimum of 48 inches long and with a minimum cross sectional area of 3.0 square inches. The maximum spacing between posts must be 5 feet and driven a minimum of 18 inches into ground. The silt fence must be entrenched to a minimum depth of 6 inches with an additional 6 inches extending along the bottom of the trench in the upslope direction.

71.13 RIPRAP AND COARSE AGGREGATE

- A. Riprap and Coarse Aggregate are specified for use in several erosion control items as shown on the detail Drawings.
- B. Where filter fabric is required on the Drawings, the fabric must conform to the Illinois Urban Manual material Specification 592 Geotextile.
- C. Coarse aggregate and riprap or rock/reclaimed concrete for Culvert Inlet Stone Protection, Rock Check Dams, Temporary Sediment Trap, Stabilized Construction Entrance, Construction Road Stabilization, and Temporary Steam Crossing must be placed in accordance with the IL Urban Manual construction Specification 25 Rockfill, using Method 1 and Class III compaction.
 - 1. Foundations for rockfill must be stripped to remove vegetation and other unsuitable materials. Earth foundation surfaces must be graded to remove surface irregularities and cavities filled with compacted earthfill of approximately the same kind and density as the adjacent foundation material. Rockfill and/or bedding must not be placed until the foundation preparation is completed and the foundation or excavations have been inspected and approved by the Engineer and CDA.
 - 2. When a bedding layer beneath rockfill is specified, the bedding material must be spread uniformly on the prepared subgrade surfaces to the depth indicated.
 - 3. Reclaimed concrete materials must be free from reinforcing bars.
 - 4. For Method 1 placement, the rock must be dumped and spread into position in approximately horizontal layers not to exceed 3 feet in thickness. It must be placed in a manner to produce a reasonably homogeneous stable fill that contains no segregated pockets of large or small fragments or large unfilled rock fragments.
 - 5. Moisture content of the bedding material must be controlled to ensure that bulking of the sand material does not occur.
 - 6. Class III Compaction of Rockfill and Bedding – No compaction will be required beyond that resulting from the placing and spreading operations.

- D. Riprap for Pipe Outlets and Structural Streambank Stabilization must be placed in accordance with the Illinois Urban Manual construction Specification 61 Rock Riprap.
1. The subgrade surfaces on which the rock riprap, filter, bedding or geotextile is to be placed must be cut or filled and graded to the lines and grades as shown on the Drawings. When fill to subgrade lines is required, it must consist of approved materials and conform to the requirements of the specified class of earthfill. Rock riprap, filter, bedding or geotextile must not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer and CDA.
 2. **Equipment–Placed Rock Riprap**
The rock riprap must be placed by equipment on the surfaces and to the depths specified. The rock riprap must be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock for riprap must be delivered and placed in a manner that will ensure that the riprap in-place will be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface. Rock riprap must be placed in a manner to prevent damage to structures. Hand placing will be required or necessary to prevent damage to any new and existing structures.
 3. **Hand–Placed Rock Riprap**
The rock riprap must be placed by hand on the surfaces and to the depths specified. It must be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks must be filled with smaller rocks and spalls. Smaller rocks must not be grouped as a substitute for larger rock. Flat slab rock must be laid on its vertical edge; except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.
 4. When the Drawings specify filter, bedding or geotextile beneath the rock riprap, the designated material must be placed on the prepared surface as specified. Compaction of filter or bedding aggregate will not be required, but the surface of such material must be finished reasonably smooth and free of mounds, dips, or windrows.

71.14 MULCH AND EROSION CONTROL BLANKET

- A. Mulch must be installed immediately after seeding by conventional method or hydromulching, after seedbed preparation, when dormant seeding is to be provided and when temporary erosion control is to be attained. Mulch must be applied any time soil and site conditions are suitable for spreading and anchoring.

- B. The erosion control blanket (single, double net or TRM) must be installed in accordance with the Manufacturer's specification and requirements. The erosion control blanket must be in firm contact with the soil. It must be anchored per the manufacturer's recommendation with the proper number and spacing of wire staples. The staples must be the proper width and length to meet the Manufacturer's specification. On slopes and in channels the blanket must be unrolled upstream to downstream parallel to the direction of flow. The upstream end and at the top of the slope, each blanket must be anchored in a minimum 6-inch deep anchor trench. The blankets must be laid like shingles, i.e., ends and edges of blanket sections must be overlapped in rows in the direction of flow.
- C. The type of erosion blanket must be based on the flow velocity and shear force in the channel.

71.15 POLYMER AND FLOC LOG

- A. All vendors and suppliers of polyacrylamide (PAM), PAM mix or blends must present or supply a written toxicity report which verifies that the PAM, PAM mix or blend exhibits acceptable toxicity parameters which meet or exceed the requirements for the state and federal water quality standards. No Cationic formulations of PAM, PAM blends, polymers of Chitosan are allowed for use under this Specification.

The manufacturer or supplier must provide a product expiration date for anionic PAM mixtures based on product expiration date of PAM in pure form.

The application method must provide uniform coverage to the target area and avoid drift to non-target areas. The applicator of anionic PAM must document, at the time of application, the following:

1. Name of applicator
2. Application rate per acre
3. Date applied
4. Product type
5. Weather conditions during application
6. Method of application

Copies of this documentation must be entered into the Contractor's monitoring log or project diary and made available upon request.

Unused liquid anionic PAM mixtures must be minimized. Excess material will not be applied at a rate greater than the maximum application rate. Disposal must not occur in Waters of the U.S. (W.U.S.) and stormwater conveyance systems (i.e. Storm sewer manholes, storm sewer inlets, ditches, and culverts).

Anionic PAM mixtures must achieve $\geq 80\%$ reduction in soil loss as measured by a 1 hour storm duration 2"/hour rainfall simulator test performed in accordance with methods used by Bubenzer and Patterson (1982) as pre-qualification for field testing.

Performance of anionic PAM mixtures must be verified and field-tested. The manufacturer must provide a toxicological report for the Polymer Binder performed by a third-party, EPA approved laboratory.

Anionic PAM use must conform to all federal, state, and local laws, rules, and regulations regarding use, discharge, and disposal of chemical materials.

- B. Floc Log Application: A Floc Log is a semi-hydrated polyacrylamide block that when placed within storm water or construction site drainages will remove fine particles and reduce NTU values. Placement of the floc log should be as close to the source of particle suspension as possible. Ideal performance of the floc logs results when used in conjunction with other best management practices. Each floc log is formulated for the soil and water chemistry at the site. Soil and water samples, when tested, will determine which formula floc log is needed along with proper placement.

71.16 TEMPORARY SEEDING

- A. This work consists of the temporary seeding of unfinished, disturbed areas as designated by the Engineer and CDA within the construction site.
- B. Except as provided in paragraphs 3.16C and 3.16D below, stabilization measures must be initiated as soon as practical in portions of the site where construction activities have temporarily or permanently ceased.
 1. Disturbed areas that will not be in the active work area for 14 to 90 days must be seeded within 24 hours after suspension of work in the area with no fertilizer or seedbed preparation, or, must be seeded within 7 working days after suspension of work in the area with no fertilizer and with rough seedbed preparation.
 - a. During dormant seasons (between June 15 and August 15 and between November 15 and December 31 or until the ground becomes frozen) mulch must be applied.
 2. Disturbed areas that will not be in the active work area for 90 to 365 days must be seeded and fertilized within 24 hours after suspension of work in the area with no seedbed preparation, or, must be seeded and fertilized within 7 working days after suspension of work in the area with rough seedbed preparation.
 - a. During dormant seasons (between June 15 and August 15 and between November 15 and December 31 or until the ground becomes frozen) mulch must be applied.
 3. Disturbed areas that will not be in the active work area for longer than one year must be seeded and fertilized in accordance with Section T-901 (Seeding) within 7 working days after suspension of work in the area with seedbed preparation.
- C. Where the initiation of stabilization measures by the 7th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures must be initiated as soon as practical.

- D. Where construction activity will resume on a portion of the site within 14 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 14 days) then stabilization measures do not have to be initiated on that portion of site by the 7th day after construction activity temporarily ceased.
- E. Dates: Temporary seeding must occur between March 15 and October 1. If protection is required outside of these dates, mulch must be used.
- F. Seed Bed Preparation: Seedbed preparation must be as described in Section T-901, Seeding. A rough seedbed must be obtained with a minimum of one pass with a disc harrow.
- G. Fertilization of Temporary Vegetation. The Contractor must perform soil tests to determine the amount of fertilizer necessary. The following rates of fertilizer application are the benchmark application rates per acre, but the Contractor must aim to minimize the amount of fertilizer used, while still allowing for the healthy growth of the seed.
 - 1. Nitrogen (N) - 120 pounds of N
 - 2. Phosphorus (P) - 60 pounds of P₂O₅
 - 3. Potassium (K) - 60 pounds of K₂O

71.17 MAINTENANCE OF TEMPORARY CONCRETE WASHOUT FACILITY

- A. Perform washout of concrete trucks in designated areas only. Each temporary washout facility must have appropriate signage to inform concrete truck drivers and equipment operators of the proper washout locations. The concrete washout facility must be installed prior to any concrete placement on site.
- B. Each facility must be located in an area protected from possible damage from construction traffic and have stabilized access to prevent tracking onto streets. Washout facilities must be located on level ground a minimum of 50 feet from storm drain inlets and open drain facilities. For smaller sites where the distance criteria may not be practical, washout facilities must be located as far from drainage facilities as possible and additional inspections must be conducted to ensure no illicit discharges occur.
- C. Washout water from low volume facilities must be allowed to evaporate and not be discharged into the environment. Washout water from high volume facilities must be removed with a vacuum truck and taken back to the batch plant.
- D. Solidified concrete waste from washout facilities shall be considered Clean Construction or Demolition Debris (CCDD) as per the Illinois Environmental Protection Act (415 ILCS 5) and must be disposed of in accordance to the Act.
- E. Temporary concrete washout facilities must be maintained to provide adequate holding capacity with a minimum freeboard of 4 inches for above grade facilities and 12 inches for below grade facilities. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is two-thirds full.

- F. Maintaining temporary concrete washout facilities must include removing and disposing of hardened concrete or slurry and waste in accordance with Federal and State regulations or as directed by the Engineer and CDA, and returning the facilities to a functional condition.
- G. When temporary concrete washout facilities are no longer required for the Work, the facilities must be removed from the site. Holes, depressions, or other ground disturbances caused by the removal must be restored to the satisfaction of the Engineer and CDA. The disturbed area must be seeded and mulched or otherwise stabilized in a manner acceptable to the Engineer and CDA.

71.18 CONSTRUCTION DETAILS

- A. The Contractor must incorporate all permanent erosion control features into the Project at the earliest practical time as outlined in the accepted schedule.
- B. Temporary erosion and pollution control measures must be used (1) to correct conditions that develop during construction that were not foreseen during the design stage; (2) where needed prior to installing permanent control features; or (3) to temporarily control erosion that develops during normal construction practices, but are not associated with permanent control features on the Project.
- C. Where erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter if the Project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.
- D. The Engineer and CDA will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures must be taken immediately to the extent feasible and justified.
- E. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or are ordered by the Engineer and CDA, such work must be performed by the Contractor at his/her own expense.
- F. The Engineer and CDA may increase or decrease the area of erodible earth material to be exposed at one time as determined by analysis of Project conditions.
- G. The erosion control features installed by the Contractor must be maintained by the Contractor during the construction period to the satisfaction of the Engineer and CDA.
- H. Whenever construction equipment must cross watercourses at frequent intervals, temporary structures must be provided.

- I. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials must not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto. Contractor must dispose all materials properly at an approved location and according to the local regulations.

71.19 OPERATION AND MAINTENANCE

- A. All installed erosion control features must, at a minimum, be inspected at least once every 7 days and within 24 hours of a storm event that produces 0.5 inches of rain or more during a 24-hour period, in accordance with NPDES permit.
- B. Removal. Unless incorporated into the permanent stormwater management system, all erosion control features must be removed and properly disposed of once final grading and stabilization has been completed, or at the direction of the Engineer and CDA.
- C. Surplus or waste material. Surplus or waste material resulting from the riprap operations must be disposed of by the Contractor at his own expense.
- D. The Contractor must be solely responsible for the maintenance of all soil erosion devices installed by the Contractor. Maintenance must be completed as soon as possible with consideration to site conditions.
- E. For each specific Erosion and Sediment control measure maintenance and inspection, refer to the Illinois Urban Manual Standard practice.

PART 72 METHOD OF MEASUREMENT

72.01 MEASUREMENT

- A. Temporary erosion and pollution control work includes all labor and materials for installation, maintenance, and removal of each erosion control item. Temporary erosion and pollution control work required which is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls must be performed as scheduled or ordered by the Engineer and CDA.
- B. Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but will be considered as a subsidiary obligation of the Contractor with costs included in the Contract prices bid for the items to which they apply. Routine maintenance of soil erosion control measures will not be paid for separately but must be considered included in the Contract pay items to which they apply. Soil erosion items damaged by Contractor must be immediately replaced at no additional cost to the Contract.

PART 73 BASIS OF PAYMENT

73.01 PAYMENT

Payment for temporary erosion control will be included in the Contract unit price for the following items; handholes, ductbank. No separate payment will be made for erosion control.

TRENCH BACKFILLING FOR FAA RELOCATIONS (SECTION P-157)

PART 1 DESCRIPTION

1.01 GENERAL:

- A. This Section must consist of furnishing, transporting and placing stabilization stone, bedding material, fine aggregate for trench backfill and acceptable fill material for all trenches (pipes or duct banks) and structure excavations. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 MATERIALS

2.01 MATERIALS:

- A. Fine aggregate for trench backfill must consist of natural sand or washed crushed limestone having a FA-6 gradation conforming to Section 1003 of the Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), Illinois Department of Transportation, latest edition.
- B. Acceptable Fill must be as defined in special provision Excavation and Embankment for FAA Relocations (Section P-152), part1.03.A.1.a.
- C. Bedding Material, except for cathodically protected pipes, must be gravel, crushed gravel, crushed stone, or crushed recycled concrete having a CA-11 gradation conforming to Section 1004 of the Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), Illinois Department of Transportation, latest edition. Bedding Material for cathodically protected (coated and wrapped) pipes must be pea gravel having a CA-16 gradation.
- D. Stabilization Stone must be crushed stone or crushed recycled concrete having CA-1 gradation conforming to Section 1004 of the S.S.R.B.C., latest edition.
- E. Where required in the Drawings, geotextile filter fabric must comply with the requirements of Section P-629.

PART 3 CONSTRUCTION METHODS

3.01 METHODS:

- A. All trenches and excavations must be backfilled within a reasonable time after the pipes are installed, unless other protection of the pipe is directed. The backfill material must be as specified herein. Backfill materials and compaction procedures must be acceptable to the Engineer and CDA. In all backfilling, any compressible or destructible rubbish and refuse must be removed from the excavated space before backfilling is started, except that sheeting and bracing must be left in place or removed as the work progresses as specified or directed.
- B. Trench excavated with sloped or benches wall must be backfilled for the full width of the trench, as herein specified.
- C. All backfill materials must be placed longitudinally along the trench. The backfill material must be brought up evenly on each side of the pipe or duct.

3.02 TRENCH STABILIZATION:

- A. If the Engineer and CDA finds that the materials encountered at the elevations specified are unstable and not suitable or in case it is found desirable or necessary to go to an additional depth, the excavation must be carried to such additional depth as the Engineer and CDA may direct in writing. The Contractor must refill such excavated space with Stabilization Stone. Stabilization Stone must be compacted to a firm but slightly yielding condition.

3.03 BEDDING:

- A. The pipe laid in trenches must be bedded in accordance with the details shown on the Plans. Bedding material must be as shown, specified or directed. Bedding must be to a minimum of spring line of the pipe. The bedding material must be placed over the stabilization stone or trench subgrade as applicable.

3.04 TRENCH BACKFILL:

- A. The fine aggregate for trench backfill must be brought up evenly on each side of the pipe or structure to an elevation 1 foot over the top of the pipe. If the trench is to be under pavement, or within 2 feet of the proposed, future or existing pavement edge, then placement and compaction of the fine aggregate trench backfill must continue until the top of subgrade is reached. If the trench is not under, or adjacent to, existing, proposed or future pavement, then acceptable fill must be placed and compacted from an elevation 1 foot over the top of the pipe to top of subgrade.

3.05 MATERIALS PLACEMENT:

- A. Material used as stabilization, bedding and fine aggregate trench backfill to 1 foot over the top of the pipe must be placed by hand in uniform layers not greater than 6 inches in loose thickness and thoroughly compacted in place. Special care must be taken to secure thorough compaction under the haunches and at the sides of the pipe.
- B. Each layer of bedding material and fine aggregate trench backfill to 1 foot over the top of the pipe must be thoroughly tamped and compacted in place with vibratory methods to not less than 90% of maximum dry density as determined by ASTM D 1557.
- C. If the backfill placed from 1 foot above the pipe is fine aggregate trench backfill, it must be placed in uniform layers not greater than 9 inches in loose thickness and thoroughly compacted in place with suitable equipment to not less than 95% of the maximum density as determined by ASTM D 1557. Each lift of Acceptable Fill must be within +/- 2% of optimum moisture content before the succeeding lift is placed. If the backfill is Acceptable Fill it must be placed in uniform layers not greater than 12 inches in loose thickness and each layer compacted to 85% of maximum density as determined by ASTM D 1557.

D. The suitability of compacting equipment will be defined per Section P-152.2.08.

3.06 FINISH GRADES:

- A. Finish grading must be performed in accordance with the completed contour elevations and grades shown and must be made to blend into the existing or plan ground surfaces. All finished grading surfaces must be left smooth and free to drain. Finish grades must be brought to elevations within plus or minus 0.10 foot of elevations or contours shown.
- B. The top 4 inches of trench fill in areas to be landscaped must be topsoil in accordance with Section T-905.
- C. Where necessary or where shown, finish grading must be extended to insure that water will be carried off and the site area left smooth and free from depressions holding water.
- D. Movement of construction machinery over a pipe or trench must be at the Contractor's risk. Any pipe damaged thereby must be replaced at the expense of the Contractor.
- E. Any depression which may develop from settlement in backfilled areas within 1 year after the work is fully completed and accepted must be the responsibility of the Contractor. The Contractor must provide, as needed, at his own expense, additional backfill material, pavement base replacement, permanent pavement repairs or replacement and must perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as acceptable to the Engineer and CDA.

3.07 TESTING:

- A. Trench backfill compaction must be tested and monitored by the Contractor a minimum of 1 test per 100 lineal feet of trench, each lift, a minimum of 3 tests per lift, or as directed by the Engineer and CDA. All material and backfill operations must be subjected to testing by the Engineer and CDA with the assistance of the Contractor.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 MEASUREMENT AND PAYMENT:

- A. No separate measurement or payment will be made for items described in this Section of the Specifications. All costs for this work will be considered included in the unit prices for the pay items requiring the various work items delineated in this Specification Section.

AGGREGATE SURFACE COURSE FOR FAA RELOCATIONS (SECTION P-413)

PART 4 GENERAL

4.01 RELATED DOCUMENTS

- A. Work under this section is subject to the requirements of the Contract Documents

1.02. DESCRIPTION OF WORK

- A. Furnish all labor, materials, tools, transportation, and equipment required for placing one or more surface courses composed of granular materials placed on a geotextile fabric upon a prepared subgrade or subbase course as shown on the drawings hereinafter referred to as the Aggregate Surface Course,

1.03 RELATED WORK

Related work specified elsewhere includes:

Excavation and Embankment for FAA Relocations (Section P-152)

Geotextile Fabric for FAA Relocations (Section P-629)

1.04 STANDARD SPECIFICATIONS

The work must conform to all the applicable portions of Section 402 of the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, including latest revisions and except as modified herein.

PART 5 PRODUCTS:

5.01 MATERIALS:

- A. The aggregate surface course material will consist of crushed stone having a gradation of CA-4 as specified on the drawings, conforming to the requirements of Article 1004.04 of the Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), latest edition.

PART 6 EXECUTION

6.01 GENERAL NOTES:

- A. The aggregate surface course is to be placed in accordance with the requirements of Section 402 of the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction, latest edition, (SSRBC) for Type B except as modified herein.

6.02 PREPARING UNDERLYING COURSE:

- A. Before any aggregate surface course is placed, the underlying subgrade must be prepared and conditioned as specified. The course must be checked and accepted by the Director before placing the geotextile fabric and aggregate spreading operations are started. The subgrade must be compacted in accordance with the requirements of Section P-152.
- B. Grade control between the edges of the pavement will be by means of grade stakes, steel pins, or forms placed in lanes parallel to the centerline of the road

and at intervals which will permit string lines or check boards to be placed between the stakes, pins, or forms.

6.03 MATERIALS ACCEPTANCE IN EXISTING CONDITION:

- A. When the subgrade is prepared in a uniform and satisfactory condition, such approved material may be moved directly to the spreading equipment for placing. The material may be obtained from stockpiles. The materials from these sources must meet the requirements for gradation, quality, and consistency. It is the intent of this section of the specifications to secure materials that will not require further mixing. The moisture content of the material must be that required to obtain maximum density. Any minor deficiency or excess of moisture may be corrected by surface sprinkling or by aeration. In such instances, some mixing or manipulation may be required, immediately preceding the rolling, to obtain the required moisture content. The final operation must be blading or dragging, if necessary, to obtain a smooth uniform surface true to line and grade.

6.04 GENERAL METHODS FOR PLACING:

- A. The aggregate surface course must be constructed in layers of a maximum of 6 inches of compacted thickness. The material, as spread, must be of uniform gradation with no pockets of fine or coarse materials. The aggregate surface course, unless otherwise permitted by the Director, must not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling must be kept within this limit. No material will be placed in snow or on a soft, muddy, or frozen subgrade.
- B. When more than one layer is required, the construction procedure described herein must apply similarly to each layer.

6.05 FINISHING AND COMPACTING:

- A. After spreading or mixing, the material must be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers must be furnished to adequately handle the rate of placing and spreading of the aggregate surface course.
- B. The field density of the compacted material must be at least 95 percent of the maximum density of laboratory specimens prepared from samples of the aggregate material delivered to the job site. The laboratory specimens must be compacted and tested in accordance with ASTM D 1557.
- C. The course must not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the subbase or subgrade. When the rolling develops irregularities that exceed ½ inch when tested with a 16'-0" straightedge, the irregular surface must be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above.
- D. Along places inaccessible to rollers, the subbase material must be tamped thoroughly with mechanical or hand tampers.

- E. Sprinkling during rolling, if necessary, must be in the amount and by equipment approved by the Director. Water must not be added in such a manner or quantity that free water will reach the underlying layer and cause it to become soft.

6.06 MAINTENANCE

- A. The Contractor must maintain the surface course throughout the duration of the Contract to keep the surface smooth by dragging or blading as many times as necessary each day. Holes, waves, and undulations which may develop and not filled by blading must be filled by adding material at no extra cost to the Contract.

PART 4 – METHOD OF MEASUREMENT

4.01 Aggregate Surface Course will be measured by the square yard in place.

PART 5 – BASIS OF PAYMENT

5.01 Payment will be made at the contract unit price per square yard for AGGREGATE SURFACE COURSE, CA-4, 6 INCH measured in place. These prices will be full compensation for furnishing all materials including the geotextile fabric, placement and compaction of the materials and all labor, equipment, tools and incidentals necessary to complete this item as shown on the plans and specified herein.

STRUCTURAL PORTLAND CEMENT CONCRETE FOR FAA RELOCATIONS (SECTION P-610)

PART 7 DESCRIPTION

7.01 GENERAL

- A. This item must consist of either plain or reinforced cast-in-place structural Portland Cement concrete and precast concrete structures, prepared and constructed in accordance with these Specifications, at the locations and of the form and dimensions shown on the Drawings. The work under this Section is subject to the requirements of the Contract Documents. Work under this Section is subject to full-time Quality Control surveillance.

7.02 SUBMITTALS

- A. Mix designs
 - 1. Submit concrete mix designs prepared by an independent testing laboratory meeting the requirements of ASTM C1077 in accordance with ACI 301 "Specifications for Structural Concrete".
- B. Shop Drawings

1. Structural concrete structure details including reinforcing steel
- C. Test Reports
1. Submit material test reports and certifications where referenced in this Specification.

PART 8 MATERIALS

8.01 GENERAL

- A. Only approved materials, conforming to the requirements of these Specifications, must be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials must be approved by the Engineer and CDA before delivery or use is started. Representative preliminary samples of the materials must be submitted by the Contractor, when required, for examination and test. Materials must be stored and handled to insure the preservation of their quality and fitness for use and must be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.
- B. In no case will the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate must be screened and washed, and all fine and coarse aggregates must be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.
- C. Reactivity: Aggregates (coarse and fine) must be tested for deleterious reactivity with alkalis in the cement, which may cause excessive expansion of the concrete. Tests of coarse and fine aggregate must be made in accordance with ASTM C1260 by an independent test laboratory that meets the requirements of ASTM C1077. If the expansion of the coarse or fine aggregate test specimens, tested in accordance with ASTM C1260, does not exceed 0.10% at 28 days (30 days from casting), the coarse or fine aggregates shall be accepted. If the expansion at 28 days is greater than 0.10%, test specimens must be made in accordance with ASTM C1567 using all components (e.g. coarse aggregate, fine aggregate, cementitious materials, and/or specific reactivity reducing chemicals) in the proportions proposed for the mixture design. If the expansion of the proposed mixture design test specimens, tested in accordance with ASTM C1567 does not exceed 0.10% at 28 days, the aggregates will be accepted. If the expansion of the proposed mixture design test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the mixture design can reduce the expansion to less than 0.10% at 28 days, or new aggregates must be evaluated and tested.

8.02 COARSE AGGREGATE

- A. The coarse aggregate for concrete must meet the requirements of IDOT S.S.R.B.C. Section 1004.

- B. Coarse aggregate must be well graded from coarse to fine and must meet one of the gradations shown in Table 1, using ASTM C 136. Independent certified test results not more than 30 days old must be submitted.

8.03 FINE AGGREGATE

- A. The fine aggregate for concrete must meet the requirements of IDOT S.S.R.B.C. Section 1003.
- B. The fine aggregate must be well graded from fine to coarse and must meet the requirements of Table 2, when tested in accordance with ASTM C 136. Independent certified test results not more than 30 days old must be submitted.

TABLE 1
 Gradation for Coarse Aggregate

Sieve Designation (square openings)	Percentage by Weight Passing Sieves				
	1-1/2"	1"	3/4"	1/2"	No. 4
No. 4. to 3/4 in.	----	100	90-100	40-70	5-15
No. 4 to 1 in.	100	90-100	----	30-60	0-10

TABLE 2
 Gradation for Fine Aggregate

Sieve Designation (square openings)	By Weight Passing Sieves
Sieve	Percentage
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	95-100
No. 16 (1.18 mm)	45-80
No. 30 (0.60 mm)	25-55
No. 50 (0.30 mm)	10-30
No. 100 (0.15 mm)	2-10

- C. Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than portland cement, as specified in 610-2.06 on admixtures, in sufficient quantity to produce the required workability as acceptable to the Engineer and CDA.

8.04 CEMENT

- A. Cement must conform to the requirements of ASTM C-150 Type I. See Paragraph 610-3.02 for the required amount of cement.
- B. The Contractor must furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the Project. The report must be delivered to the Engineer and CDA before permission to use the cement is granted. All such test reports may be subject to verification by testing sample materials received for use on the Project.

8.05 WATER

- A. The water used in concrete must be free from sewage, oil, acid, strong alkalis, vegetable matter, and clay and loam. If the water is of questionable quality, it must be tested in accordance with AASHTO T 26. Water known to be of potable quality may be used without testing.

8.06 ADMIXTURES

- A. The use of any material added to the concrete mix must be acceptable to the Engineer and CDA. Before acceptance of any material, the Contractor must be required to submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests may be made of samples taken by the Engineer and CDA from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that accepted.
- B. Pozzolanic admixtures must be fly ash meeting the requirements of ASTM C 618, Class F.
- C. Air-entraining admixtures must meet the requirements of ASTM C 260. Air-entraining admixtures must be added at the mixer in the amount necessary to produce the specified air content.
- D. Water-reducing, set-controlling admixtures must meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding.
- E. Water-reducing admixtures must be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

8.07 STEEL REINFORCEMENT

- A. Reinforcing must consist of deformed reinforcement bars conforming to the requirements of ASTM A 615 Grade 60.

8.08 COVER MATERIALS FOR CURING

- A. Curing materials must conform to one of the following Specifications:
 - 1. Waterproof Paper for Curing Concrete - ASTM C 171.
 - 2. Polyethylene Sheeting for Curing Concrete - ASTM C 171.
 - 3. Liquid Membrane-Forming Compounds for Curing Concrete - ASTM C 309, Type 2.

PART 9 CONSTRUCTION METHODS

9.01 GENERAL

- A. The Contractor must furnish all labor, materials, and services necessary for, and included in the completion of all work as shown on the Drawings and specified herein. All machinery and equipment owned or controlled by the Contractor, which he or she proposes to use on the work, must be of sufficient size to meet the requirements of the work, and must be such as to produce satisfactory work; all work will be subject to inspection and acceptance by the Engineer and CDA.

9.02 CONCRETE COMPOSITION

- A. Cast-in-place concrete must develop a minimum compressive strength of 4,000 pounds per square inch in 28 days, except as otherwise noted on the Plans or in the Specifications, as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete must contain not less than 535 pounds of total cementitious materials per cubic yard (318 kg per cubic meter). The concrete must contain 6 percent of entrained air, plus or minus 1 percent, as determined by ASTM C 231. The concrete must have a slump of not more than 4 inches (10 cm) as determined by ASTM C 143. For placement where workability may require a slump higher than 4 inches, the Contractor may adjust the slump upwards subject to the mix not exceeding a water cement ratio of 0.45 and that batch weights are obtained from the concrete supplier and the Contractor QC organization conducts calculations to ensure that the water/cement ratio is not exceeded, subject to the approval by the Engineer and CDA on a case-to-case basis.
- B. The Contractor must employ at his expense, an independent quality control testing laboratory that meets the requirements of ASTM C1077 and approved by the Engineer and CDA, to design the mix for each type of concrete required in accordance with the Specifications and Drawings. Mix designs prepared by concrete manufacturers must be tested and verified by the quality control testing laboratory for conformity with the Specifications and submitted to the Engineer and CDA for review. No concrete will be placed until the mix design and 28 day strength test results are submitted and accepted by the Engineer and CDA.

9.03 ACCEPTANCE SAMPLING AND TESTING

- A. Cast-in-place concrete for each structure will be accepted on the basis of the compressive strength specified in Paragraph 3.02. The concrete must be sampled in accordance with ASTM C 172. Compressive strength specimens must be made by the Contractor in accordance with ASTM C 31. Tests for slump (ASTM C143), air content (ASTM C231), and temperature (ASTM C1064) must be made by the Contractor on the first load and last load and for every 50 cubic yards of each days placement of concrete. Compressive strength specimens (1 cylinder to be tested at 7 days, 1 at 14 days, 2 at 28 days) must be casted by the Contractor in accordance with ASTM C 31, for each 100 cubic yards placed with a minimum of one set per day's placement.

- B. The Contractor must make and initially cure and store the test specimens in accordance with ASTM C31. The Contractor must transport and deliver the test specimens to the Engineer and CDA's laboratory for testing. A Chain of Custody form provided by the Engineer and CDA must be used. The Contractor must be responsible for developing a system of recording the initial curing temperatures and this data must be sent to the Engineer and CDA's laboratory with the test specimens. The Engineer and CDA will make the actual tests on the specimens in accordance with ASTM C 39 at no expense to the Contractor.

9.04 PROPORTIONING AND MEASURING DEVICES

- A. When package cement is used, the quantity for each batch must be equal to one or more whole sacks of cement. The aggregates must be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge must be contained in each batch compartment. Weighing boxes or hoppers must be approved by the Engineer and CDA and must provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.

9.05 CONSISTENCY

- A. The consistency of the concrete must be checked by the slump test specified in ASTM C 143.

9.06 MIXING

- A. Concrete may be mixed at the construction site, at a central point, and/or wholly or in part in truck mixers. The concrete must be mixed and delivered in accordance with the requirements of ASTM C 94.

9.07 MIXING CONDITIONS

- A. The concrete must be mixed only in quantities required for immediate use. Concrete must not be mixed while the air temperature is below 40 degrees F (4 degrees C) without permission of the Engineer and CDA. If permission is granted for mixing under such conditions, aggregates or water, or both, must be heated and the concrete must be placed at a temperature not less than 50 degrees F (10 degrees C) nor more than 90 degrees F (32 degrees C). The Contractor must be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and must replace such work at his or her expense.
- B. No retempering of concrete by adding water or any other material is permitted.
- C. The delivery of concrete to the job must be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

9.08 FORMS

- A. Concrete must not be placed until all the forms and reinforcements have been inspected and acceptable to the Engineer and CDA. Forms must be of suitable material and must be of the type, size, shape, quality, and strength to build the structure as designed on the Plans. The forms must be true to line and grade and must be mortar-tight and sufficiently rigid to prevent displacement and

sagging between supports. The Contractor must bear responsibility for their adequacy. The surfaces of forms must be smooth and free from irregularities, dents, sags, and holes.

- B. The internal ties must be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. All forms must be wetted with water or with a nonstaining mineral oil which must be applied shortly before the concrete is placed. Forms must be constructed so that they can be removed without injuring the concrete or concrete surface. The forms must not be removed from vertical faces, walls, slender columns, and similar structures before the expiration of at least 30 hours; forms supported by falsework under slabs, beams, girders, arches, and similar construction must not be removed until tests indicate that at least 60% of the design strength of the concrete has developed.

9.09 PLACING REINFORCEMENT

- A. All reinforcement must be accurately placed, as shown on the Plans, and must be firmly held in position during concreting. Bars must be tied at all intersections except where the center to center dimension is less than 1 foot in each direction, in which case alternate intersections may be tied. The reinforcement must be supported by approved metal chairs. Shop Drawings, lists, and bending details must be supplied by the Contractor when required.

9.10 EMBEDDED ITEMS

- A. Before placing concrete, any items that are to be embedded must be firmly and securely fastened in place as indicated. All such items must be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood must be avoided. The concrete must be spaded and consolidated around and against embedded items.

9.11 PLACING CONCRETE

- A. All concrete must be placed during daylight, unless otherwise approved. The concrete must not be placed until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved. Concrete must be placed as soon as practical after mixing and in no case later than 60 minutes after water has been added to the mix. The method and manner of placing must be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes must be used as an aid in placing concrete when necessary. Dropping the concrete a distance of more than 5 feet, or depositing a large quantity at one point, will not be permitted. Concrete must be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.
- B. The concrete must be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating must be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators must be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any joint must be of sufficient duration to accomplish compaction

but must not be prolonged to the point where segregation occurs. Concrete deposited under water must be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and must not be disturbed after being deposited.

9.12 CONSTRUCTION JOINTS

- A. When the placing of concrete is suspended, necessary provisions must be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, such provisions must be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work must be arranged so that a section begun on any day must be finished during daylight of the same day. Before depositing new concrete on or against concrete which has hardened, the surface of the hardened concrete must be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

9.13 DEFECTIVE WORK

- A. Any defective work disclosed after the forms have been removed must be immediately removed and replaced. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer and CDA cannot be repaired satisfactorily, the entire section must be removed and replaced at the expense of the Contractor.

9.14 SURFACE FINISH

- A. All exposed concrete surfaces must be true, smooth and free from open or rough spaces, depressions, or projections greater than ¼-inch of the proposed finish. The concrete in horizontal plane surfaces must be brought flush with the finished top surface at the proper elevation and must be struck-off with a straightedge and floated. Mortar finishing will not be permitted, nor must dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.
- B. When directed, the surface finish of exposed concrete must be a rubbed finish. If forms can be removed while the concrete is still green, the surface must be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone must be used to finish the surface. When approved, the finishing can be done with a rubbing machine. Surfaces subject to foot traffic must have a broom finish.

9.15 CURING AND PROTECTION

- A. All concrete must be properly cured and protected by the Contractor. The work must be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete must be cured as soon as it has sufficiently hardened by covering with an approved material. Membrane-forming curing compound must be applied in accordance with the manufacturer's recommendations. Water-absorptive coverings must be thoroughly saturated when placed and kept saturated for a period of at least 3 days. All curing mats or blankets must be sufficiently weighted or tied down to keep the concrete surface

covered and to prevent the surface from being exposed to currents of air or blown about due to the blast of jet engines. Where wooden forms are used, they must be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic or loading must not be allowed on concrete surfaces for 7 days after the concrete has been placed. If the Contractor seeks permission from the Engineer and CDA to place traffic or load before 7 days, the Contractor QC and his laboratory must make and break additional cylinders for this purpose, subject to verification by the Engineer and CDA.

9.16 DRAINS OR DUCTS

- A. Drainage pipes, conduits, and ducts that are to be encased in concrete must be installed by the Contractor before the concrete is placed. The pipe must be held rigidly so that it will not be displaced or moved during the placing of the concrete.

9.17 HOT AND COLD WEATHER PROTECTION

- A. The Contractor will not be entitled to additional compensation for satisfying the hot weather or cold weather placement requirements below.
- B. The Contractor must place concrete in accordance with ACI 305R Hot Weather Concreting and ACI 306.1 Standard Specification for Cold Weather Concreting.
- C. If concrete is placed where the weather is such that the temperature of the concrete could exceed 90 degrees Fahrenheit, the Contractor must employ effective means such as pre-cooling of aggregates or using ice as necessary to maintain the temperature of concrete below 90 degrees Fahrenheit as it is placed.
- D. When concrete is placed at temperatures below 40 degrees F (4 degrees C), the Contractor must provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, must be heated in order to place the concrete at temperatures between 50 degrees and 90 degrees F. Snow, ice, and frost must be removed from the surfaces, including reinforcement against which concrete is to be placed. Before beginning concrete placement, the subgrade must be thawed.
- E. Calcium chloride must not be used in the concrete mix. After the concrete has been placed, the Contractor must provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50 degrees F (10 degrees C) until at least 60% of the designed strength has been attained.
- F. The Contractor must submit detailed procedures for production, transportation, placement, protection curing, testing and temperature monitoring of concrete during hot or cold weather. The Hot or Cold Weather Concreting Plan must include procedures to be implemented upon abrupt changes in weather conditions or equipment failures.

9.18 FILLING JOINTS

- A. All joints which require filling must be thoroughly cleaned, and any excess mortar or concrete must be cut out with proper tools. Joint filling must not be started until after final curing and must be done only when the concrete is completely

dry. The cleaning and filling must be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

9.19 PRECAST CONCRETE

- A. At the option of the Contractor and subject to the approval by the Engineer and CDA, some cast-in-place structures such as manholes, handholes, and drainage structures may be substituted with precast concrete. If precast concrete is adopted, it will be subject to the requirements of the applicable portions of Sections 504, 1020, and 1042 or other Sections or articles cited elsewhere in this Specifications of the following:
1. "Standard Specifications for Road and Bridge Construction: (SSRBC) prepared by the Illinois Department of Transportation, latest edition. The SSRBC is referred to in the following Articles as the "Standard Specifications" and as except as may be otherwise stated, the work to be done under Precast Concrete must conform to the requirements of said "Standard Specifications".
 2. Where the "Standard Specifications" refer to "Engineer", it will be understood to mean "Engineer and CDA".
 3. Where the "Standard Specification refer to "Engineer" for required tests and inspections, it will be understood to mean "Contractor".
 4. Standard Specifications articles referring to "Method of Measurement" and "Basis of Payment" are not applicable.
- B. Precast concrete materials must meet the requirements of Article 504.02 as applicable and equipment must meet the requirements of Article 504.03.
- C. The precast unit manufacturer must have a minimum of 5 years experience in producing precast/precast prestressed units and must have a current Prestressed Concrete Institute quality program certification which demonstrates its registration to the ISO 9002 standard or approved equal. A copy of the certification must be submitted to the Engineer and CDA for review.
- D. Concrete materials must be combined so as to produce a concrete meeting all the requirements specified in Articles 1020.04, 1020.05, and 1042.03 for Class PC Concrete (Mix design compressive strength of 4,500 psi minimum at 28 days) for precast structures. Other concrete mix designs proposed by the Contractor must be submitted for review and approval by the Engineer and CDA. Aggregates must conform to the requirements of Articles 1003.02 and 1004.02 with the exception of gradation. It will be the Contractor's responsibility to determine the proportions of the materials for the concrete, and to exercise quality control with respect to the mixture, so that each batch of concrete entering into the members will meet the requirements specified. Batches of concrete not meeting the requirements as to slump and entrained air content will be rejected.
- E. Before the work begins, the Contractor must furnish the Engineer and CDA a listing of the name, source, brand or type and/or supplier for each of the materials, and must secure the Engineer and CDA's approval of the proportions

of cement, fine aggregate, coarse aggregate, admixtures and water the Contractor proposes to use.

- F. Precast construction requirements must be in accordance with the applicable provisions of Articles 504.05 and 504.06.
- G. Slump, air content, and strength tests for precast concrete must be in accordance to the applicable provisions of Articles 1020.07, 1020.08, and 1020.09, respectively. Certified concrete test results must be submitted in a timely manner by the Contractor for review of the Engineer and CDA. Handling, measuring, batching, and mixing of precast concrete must be in accordance with Articles 1020.10 and 1020.11. The Director reserves the right to inspect and witness the manufacture of the precast units and the testing of concrete samples.
- H. Precast sections must be installed in horizontal courses. The units must be laid in mortar, sealed with external sealing bands, or sealed using mortar joint sealer. When mastic joint sealer is used, the material shall completely fill the joint after the units have been brought together. All precast units shall be installed on a 6" thick sand cushion of FA-6 compacted to 95% Modified Proctor ASTM D1557, or as shown on the Drawings.

PART 10 METHOD OF MEASUREMENT

10.01 MEASUREMENTS

- A. Cast-in-place and precast Portland Cement concrete, either plain or reinforced, and the reinforcing steel will not be measured separately for payment but will be included in the unit of measurement: handholes, ductbank, light tower foundations.

PART 11 BASIS OF PAYMENT

11.01 PAYMENTS

- A. Payment for Cast-in-Place and Portland cement concrete, either plain or reinforced, will be made at the Contract unit price for designated item and unit of measurement, including but not limited to: handholes, ductbank, light tower foundations. Reinforcing steel will not be paid for separately but will be included in the unit price bid for the designated item.

GEOTEXTILE FABRIC FOR FAA RELOCATIONS (SECTION P-629)

PART 12 DESCRIPTION

12.01 GENERAL

- A. This work must consist of furnishing and placing geotextile fabrics for use as shown on the Typical Sections of the Plans and Drawings. The work under this Section is subject to the requirements of the Contract Documents.

PART 13 MATERIALS

13.01 GEOTEXTILES

- A. Fibers, used in the manufacture of geotextiles, and thread, used in joining geotextiles by sewing, must consist of long chain synthetic polymers, composed of at least 95%, by weight, polypropylene or polyester. The material must be free of defects and tears and must meet or exceed the material requirements as listed below.
- B. The geotextile must meet or exceed the minimum property values in Table 1.

TABLE 1
 Physical Property Requirements

Test	Woven ¹	Nonwoven ¹
Grab Tensile Strength (ASTM D-4632)	270 lbs	180 lbs
Puncture Resistance (ASTM D-4833)	100 lbs	75 lbs
Trapezoid Tear Strength (ASTM D-4533)	100 lbs	75 lbs
Apparent Opening Size (ASTM D-4751)	< 0.3 mm	
Permittivity (ASTM D-4991)	>1.5 sec ⁻¹	
Flow Rate (ASTM D-4991)	> 70 gpm/ft ²	
Ultraviolet Degradation (ASTM D-4355)	> 70% strength 500 hrs exposure	

¹Values shown are minimum average roll values with strength values based on the weaker principle direction. Specification conformance of the geotextile must be based on the ASTM D-4759 procedure.

- C. In addition to the above requirements, the following limitations will also apply:
 - 1. If the fabric must be in contact with asphalt, it must be capable of withstanding temperatures of 338 degrees F without any negative effect on material's properties.
- D. Geotextile Fabric for Temporary Erosion Control

1. Geotextile fabric materials for silt fence and temporary erosion control devices are specified separately under Section P-156 Temporary Air and Water Pollution, Soil Erosion, and Sediment Control.

PART 14 SUBMITTALS

14.01 CERTIFICATE OF COMPLIANCE

- A. Before starting the work, the Contractor must submit:
 1. A Certification of Compliance from the geotextile manufacturer that the product(s) delivered to the Project will have property values equal to or greater than those specified, and
 2. Factory test results of materials certified by the manufacturer as being similar, showing conformance with the requirements of these Specifications. Certified property values must be equal to the average value less two standard deviations. A swatch of the geotextile to be used must be submitted with the certification letter.
- B. For quantities over 10,000 square yards, the Contractor must furnish to the Engineer, CDA, and FAA, at least 10 working days prior to use in the work, a sample of five square yards of the geotextile from the shipment of materials to be used on the Project of verification testing. The lot number of the roll and the location of the sample obtained must be documented.
- C. After Contract award, upon request, the geotextile manufacturer must make available quality control test results for the materials delivered to the Project. Quality control sampling must be done in accordance with ASTM D-4354, and the samples must be tested according to ASTM standards to grab tensile strength, trapezoidal tear strength, and puncture resistance. At least one AOS and one permeability test must be performed per lot number.

PART 15 PACKAGING, STORAGE, AND HANDLING OF MATERIALS

15.01 PACKAGING

- A. Geotextile materials delivered to the site must be furnished with an outer plastic wrapping, suitable for protection against moisture and extended ultraviolet exposure prior to placement. An opaque tarp must be placed over all rolls where the outer wrap is removed or damaged, such that the geotextile is exposed.
- B. Each role of geotextile must be externally labeled or tagged to provide product identification sufficient for field identification, as well as inventory and quality control purposes. As a minimum, external tagging must include:
 1. Name of Manufacturer
 2. Product Type and Style
 3. Product Grade
 4. Lot Number
 5. Physical Dimensions (Length and width)

- C. The product grade, manufacturer's name, and lot number must be clearly marked directly on the geotextile at the beginning and end of each roll of product.
- D. Rolls must be stored in a manner which protects them from the elements. If stored outdoors, they must be elevated and protected with a waterproof cover.

PART 16 INSTALLATION

16.01 GENERAL

- A. The installation site must be prepared by clearing and grading the areas, as indicated on the Plans. Remove all sharp objects, large stones, stumps, etc.
- B. The geotextile must be unrolled as smoothly as possible with no wrinkles or folds (except in curved sections and corners) on the prepared subgrade in the direction of construction traffic. Adjacent rolls must be overlapped of 12 inches or greater, as shown on the Plans. Adjacent rolls may be connected by sewn or sealed seams, provided the seam meets or exceeds the grab strength requirement in Table 1.
- C. For curves, the geotextile must be folded or cut and overlapped in the direction of the turn. Overlaps must be 12 inches or greater. Folds in geotextile must be stapled or pinned five feet on center.
- D. The frost protection material must be placed onto the geotextile from the edge of the fabric or over previously placed aggregate. The first lift of aggregate must be spread and graded down to a minimum depth of 12 inches or to the design thickness, if less than 12 inches. A minimum lift of six inches compacted thickness must be maintained in all cases. Compaction of the first lift must be performed by "tracking" with a dozer, followed by compaction with a smooth-drum roller to the specified density. Construction vehicles that create ruts in the apron surface of greater than three inches will not be allowed. All ruts occurring during construction must be filled with additional aggregate and compacted to the specified density. Sudden stops and starts must be avoided where possible.
- E. Holes, tears, or otherwise damaged geotextiles, as determined by the Engineer, CDA, and FAA, must be repaired immediately at the Contractor's expense. The damaged area must be cleared of all fill material, a suitable distance from the damaged area, to allow placement of a geotextile patch which extends 3 feet beyond perimeter of the damaged area. Aggregate removed must be replaced to the specified lift thickness and density.

PART 17 METHOD OF MEASUREMENT

17.01 MEASUREMENTS

- A. The geotextile fabric will not be measured for payment, but will be considered included in the Aggregate Surface Course, CA-4, 6 Inch pay item and in other areas where it is required as shown on the Drawings.

PART 18 BASIS OF PAYMENT

18.01 PAYMENTS

- A. No separate payment for geotextile fabrics will be made.

QUALITY CONTROL PROGRAM FOR FAA RELOCATIONS (SECTION Q-100)

PART 19 GENERAL

19.01 DESCRIPTION

- A. The Contractor must establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction for all work items included under this project, as described in the Contract Documents, conform to the contract requirements, whether manufactured by the Contractor or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor must assume full responsibility for accomplishing the stated purpose. This purpose will be included in a mission statement for the program.
- B. The intent of this section is to enable the Contractor to establish a necessary level of control prior to performing work that will:
 - 1. Adequately provide for the production of acceptable quality materials.
 - 2. Provide sufficient information to assure both the Contractor and the Engineer, CDA, and FAA that the specification requirements must be met.
 - 3. Allow the Contractor as much latitude as possible to develop its own standard of quality control.
- C. The Contractor is to discuss and present, in an oral presentation at the preconstruction conference, its understanding of the quality control requirements. The Quality Control Program will be submitted to the Engineer, CDA, and FAA at the preconstruction conference. The Contractor must not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed and accepted by the Engineer, CDA, and FAA. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been accepted by the Engineer, CDA, and FAA.
- D. The requirements for the Contractor's Quality Control Program contained in this section are in addition to and separate from the acceptance testing requirements stated in the technical specifications. Acceptance testing requirements will be as specified in the individual technical specifications.

19.02 DESCRIPTION OF PROGRAM

- A. General Description. This Quality Control Program will ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program will be effective for control of all construction work performed under this Contract and will specifically include full-time surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

- B. Quality Control Program. The Contractor must describe the Quality Control Program in a written document which will be reviewed by the Engineer, CDA, and FAA prior to the start of any production, construction, or off-site fabrication. The written Quality Control Program will be submitted to the Engineer, CDA, and FAA for review at the preconstruction conference.

The Quality Control Program will be organized to address, as a minimum, the following items:

1. Quality control organization;
 2. Project progress schedule;
 3. Submittals schedule;
 4. Inspection requirements;
 5. Quality control testing plan;
 6. Documentation of quality control activities; and
 7. Requirements for corrective action when quality control and/or acceptance criteria are not met.
- C. The Contractor is encouraged to add any additional elements to the Quality Control Program that it deems necessary to adequately control all production and/or construction processes required by this contract.

19.03 QUALITY CONTROL ORGANIZATION

- A. The Contractor's Quality Control Program must be implemented by the establishment of a separate quality control organization. An organizational chart must be developed to show all quality control personnel and how these personnel integrate with other management/production and construction functions and personnel. In addition, a letter from the President of the company certifying the authority given to the Program Administrator and the QC organization, in accordance with the requirements of the Contract Documents, must be included as part of the plan.
- B. The organizational chart must identify all quality control staff by name and function, and must indicate the total staff required to implement all elements of the Quality Control Program, including full-time inspection, testing and full time surveillance for each item of work. Different technicians must be utilized for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the Quality Control Program, the personnel assigned must be subject to the qualification requirements of Paragraphs 1.03.D.1 and 1.03.D.2. The organizational chart must indicate which personnel are Contractor employees and which are provided by an outside organization. The Program Administrator will be required to conduct a documented training session, detailing the aspects of the Quality Control Program. All project foremen, superintendents, project managers and QC technicians, whether employed by the Contractor, subcontractor or outside testing organization must attend. The Engineer, CDA, and FAA will have the opportunity to have his designees attend this training. In

addition, the Program Administrator will conduct a pre-activity meeting at least 2 workdays in advance of any activity of work. This meeting must be attended by the Superintendent and Foreman responsible for the work, with notification to the CM Quality Assurance Manager and Resident Engineer. QC and QA Technicians are encouraged to attend.

- C. Payment will not be made for any materials installed without Quality Control inspection by the Contractor. In addition, the Engineer, CDA, and FAA may withhold, or deny payment for an inspected item, if in the Engineer, CDA, and FAA's opinion; the Contractor's Quality Control Program is not functioning as required by the project specifications.
- D. The quality control organization will consist of the following minimum personnel:
 - 1. Program Administrator. The Program Administrator will be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The Program Administrator will be acceptable to the Engineer, CDA, and FAA and will have had prior quality control experience on a project of comparable size and scope as this contract.
 - a. Additional qualifications for the Program Administrator will include at least one (1) of the following requirements:
 - (1) Professional engineer with 1 year of airport paving experience acceptable to the Engineer, CDA, and FAA.
 - (2) Engineer-in-training with 2 years of airport paving experience acceptable to the Engineer, CDA, and FAA.
 - (3) An individual with 3 years of highway and/or airport paving experience acceptable to the Engineer, CDA, and FAA, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.
 - (4) Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).
 - (5) Highway materials technician certified at Level III by NICET.
 - (6) Highway construction technician certified at Level III by NICET.
 - (7) A NICET certified engineering technician in Civil Engineering Technology with 5 years of highway and/or airport paving experience acceptable to the Engineer, CDA, and FAA.
 - (8) Certification of technicians at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.
 - b. The Program Administrator will have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Program Administrator will report directly to a responsible officer of the construction firm and will be independent from the field operation.

2. Quality Control Technicians. A sufficient number of quality control technicians necessary to adequately implement the Quality Control Program will be provided. These personnel will be engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II or higher construction materials technician or highway construction technician and will have a minimum of 2 years of experience in their area of expertise, and have the necessary certifications appropriate for the testing and inspection performed.
 - a. The quality control technicians will report directly to the Program Administrator and will perform the following functions:
 - (1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by Paragraph 1.06.
 - (2) Performance of all quality control tests as required by the technical specifications and Paragraph 1.07.
 - b. Certification of technicians at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.
3. Staffing Levels. The Contractor must provide qualified quality control staff to monitor each work activity on a full time basis. The Engineer, CDA, and FAA will make the final determination as to the adequacy of quality control staffing levels and personnel. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians will be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program will state where different technicians will be required for different work elements.

19.04 PROJECT PROGRESS SCHEDULE

- A. The Contractor must submit a coordinated construction schedule for all work activities. The schedule must be prepared as a network diagram as specified in Part Two of the Specifications, Article VIII, Paragraph D. of the CDA standard specifications.

19.05 SUBMITTALS SCHEDULE

- A. The Contractor must submit a detailed listing of all submittals (e.g., mix designs, material certifications) and Shop Drawings prior to the start of work required by the technical specifications. The listing can be developed in a spreadsheet format and must include:
 1. Specification item number;
 2. Item description;
 3. Description of submittal;
 4. Specification paragraph requiring submittal;
 5. Scheduled date of submittal;

6. Submittal approval level; and
 7. Contractor/subcontractor responsible.
- B. This spreadsheet must be produced and maintained by the Contractor's Project Manager on a bi-weekly basis and will be reviewed by the Program Administrator prior to submission to the Engineer, CDA, and FAA.

19.06 INSPECTION REQUIREMENTS

- A. Quality control inspection functions included in the Contractor's Quality Control Program will be organized to provide full-time inspections by the Contractor's personnel or by an outside organization provided by the Contractor, as detailed below. All such inspections must be documented by the Contractor as specified in Paragraph 1.08.
- B. Inspections will be performed daily to ensure continuing compliance with contract requirements until completion of the particular feature of work. These will include the following minimum requirements:
1. During plant operation for material production, quality control test results and full time inspections will be utilized to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment utilized in proportioning and mixing will be inspected to ensure its proper operating condition. The Quality Control Program will detail how these and other quality control functions will be accomplished and utilized.
 2. During field operations, quality control test results and full time inspections will be utilized to ensure the quality of all materials and workmanship. All equipment utilized in placing, finishing, and compacting will be inspected and calibrated as necessary to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program will document how these and other quality control functions will be accomplished and utilized.

19.07 QUALITY CONTROL TESTING PLAN

- A. As a part of the overall Quality Control Program, the Contractor must implement a quality control testing plan, as required by the technical specifications. The testing plan will include the minimum tests and test frequencies required by each technical specification Item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.
- B. The testing plan can be developed in a spreadsheet fashion and will, as a minimum, include the following:
1. Specification item number (e.g., P-401);
 2. Item description (e.g., Plant Mix Bituminous Pavements);

3. Test type (e.g., gradation, grade, asphalt content);
 4. Test standard (e.g., ASTM or AASHTO test number, as applicable);
 5. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated; where no minimum test frequency is specified for aggregate gradations, one gradation test must be run per 5000 tons per aggregate type delivered or a minimum of one test per week, and one modified proctor ASTM D 1557 test must be run at a minimum of double the frequency above, or when materials substantially change as determined by the Engineer, CDA, and FAA);
 6. Responsibility (e.g., plant technician); and
 7. Control requirements (e.g., target, permissible deviations).
- C. The testing plan will contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D 3665. The Engineer, CDA, and FAA will be given access to witness all quality control sampling and testing.
- D. All quality control test results must be documented by the Contractor as specified in Paragraph 1.08.

19.08 DOCUMENTATION

- A. The Contractor must maintain current quality control records of all inspections and tests performed under the Quality Control Program. These records must include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.
- B. These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the Contract Documents. Legible copies of these records must be furnished to the Engineer, CDA, and FAA daily, at a time established by the Engineer, CDA, and FAA at the pre-construction conference. The records must cover all work placed subsequent to the previously furnished records and must be verified and signed by the Contractor's Program Administrator and the inspector.
- C. Specific Contractor quality control records required for the contract must include, but are not necessarily limited to, the following records:
1. Daily Inspection Reports. Each Contractor quality control technician must maintain a daily log of all inspections performed for both Contractor and subcontractor operations on a form acceptable to the Engineer, CDA, and FAA. These technician's daily reports must provide factual evidence that continuous quality control inspections have been performed and will, as a minimum, include the following:
 - a. Technical specification item number and description;
 - b. Compliance with approved submittals;

- c. Proper storage of materials and equipment;
 - d. Proper operation of all equipment;
 - e. Adherence to plans and technical specifications;
 - f. Review of quality control tests; and
 - g. Safety inspection.
- D. The daily inspection reports must identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.
- E. The daily inspection reports will be signed by the responsible quality control technician and the Program Administrator. The Engineer, CDA, and FAA will be provided at least one legible original copy of each daily inspection reports, by 10:00 am on the work day following the day of record.
- 1. Daily Test Reports. The Contractor must be responsible for establishing a system which will record all quality control test results. Daily test reports must document the following information:
 - a. Technical specification item number and description;
 - b. Test designation;
 - c. Location;
 - d. Date and time of test;
 - e. Control requirements;
 - f. Test results;
 - g. Causes for rejection;
 - h. Recommended remedial actions; and
 - i. Retests.
 - 2. Checklists. The Quality Control Program Administrator must develop Checklists for each specification section in the Contract Documents. The Checklist must summarize the major items contained in the technical specifications and include a check box signifying compliance designated "Yes", "No" or "N/A". Each Quality Control Technician must fill out a Checklist for each specification section worked on that day. The form must also include:
 - a. Date
 - b. Shift
 - c. Specification Section
 - d. QC Conformance – Yes/No
 - e. Non-Conformance Report (NCR) Number
 - f. Contractor
 - g. Pay Item Number and Description
 - h. Location
 - i. Comments
 - j. Signatures of Technicians and Program Administrator
- F. Test results from each day's work period must be submitted to the Engineer, CDA, and FAA prior to the start of the next day's work period. When required by the technical specifications, the Contractor must maintain statistical quality

control charts. The daily test reports will be signed by the responsible quality control technician and the Program Administrator.

19.09 CORRECTIVE ACTION REQUIREMENTS

- A. The Quality Control Program will indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action will include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.
- B. The Quality Control Program will detail how the results of quality control inspections and tests will be used for determining the need for corrective action and will contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.
- C. When applicable or required by the technical specifications, the Contractor must establish and utilize statistical quality control charts for individual quality control tests. The requirements for corrective action will be linked to the control charts.

19.10 SURVEILLANCE BY THE ENGINEER, CDA, AND FAA

- A. All items of material and equipment will be subject to surveillance by the Engineer, CDA, and FAA at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed herein and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place will be subject to surveillance by the Engineer, CDA, and FAA at the site for the same purpose.
- B. Surveillance by the Engineer, CDA, and FAA does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.
- C. Any testing performed by the Engineer, CDA, and FAA and deemed by the Contractor to be improperly performed will be noted on the Daily Inspection Report. In addition, a written document by the Program Administrator will be submitted indicating the deviation noted. Testing procedures will be considered accurate and correct unless this procedure is followed. The Contractor must not seek additional compensation for any testing irregularities not reported.
- D. Any testing performed by the Contractor and deemed by the Contractor to be improperly performed or not meeting the requirements of the project specifications must be noted by the Contractor on their daily inspection reports.
- E. No videotaping or recording of QA or QC personnel will be permitted unless written permission is given by both parties.

19.11 NONCOMPLIANCE

- A. The Engineer, CDA, and FAA will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor must, after receipt of such notice, immediately take corrective action. Any notice, when delivered by

the Engineer, CDA, and FAA or its authorized representative to the Contractor or its authorized representative at the site of the work, must be considered sufficient notice.

- B. In cases where quality control activities do not comply with either the Contractor's Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Engineer, CDA, and FAA, the Engineer, CDA, and FAA may:
1. Order the Contractor in writing to replace ineffective or unqualified quality control personnel or subcontractors within 24 hours after receipt of such order.
 2. Order the Contractor to stop operations until appropriate corrective actions are taken.
 3. Withhold progress payments in the event of Contractor failure to take corrective actions within the specified time.

PART 20 PRODUCTS

20.01 NOT APPLICABLE

PART 21 EXECUTION

21.01 NOT APPLICABLE

PART 22 METHOD OF MEASUREMENT

22.01 MEASUREMENT

- A. Contractor quality control program will not be measured for payment and will be considered included in the total contract price.

PART 23 BASIS OF PAYMENT

23.01 PAYMENT

- A. The preparation of a Quality Control Program and its implementation, including any corrective measures that may be required to be carried out by the Contractor to bring items of work into compliance with the requirements of the Quality Control Program and the technical specifications will not be paid for separately but will be included in the total Contract price.

SEEDING FOR FAA RELOCATIONS (SECTION T-901)

PART 24 DESCRIPTION

24.01 GENERAL

- A. This item consists of seeding in the areas shown on the Plans to be regraded or as directed by the Engineer and CDA in accordance with these Specifications.

PART 25 MATERIALS

25.01 SEED

- A. The kinds of grass, legume, and cover-crop seed furnished must be those stipulated herein. Seed must conform to the requirements of the Illinois Department of Transportation (IDOT) Standard Specification for Road and Bridge Construction (SSRBC), latest edition, Article 1081.04 unless otherwise specified in this Specification. For Tall Fescue varieties shown in 2.01C, use parameters specified for "Fescue Inferno Tall" in Table II of Article 1081.04.
- B. Seed must be furnished separately or in mixtures in standard containers with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor must furnish the Engineer and CDA duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within 6 months of date of delivery. This statement must include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed.
- C. Seeds must be spread uniformly at the rate and mixture specified below in pounds per acre of pure live seed (PLS):

<u>Grass Seed Blend</u>	<u>lb/acre PLS</u>
<u>Type 1 – CDA Permanent Seed Mix</u>	
Tall Fescue (<i>Festuca arundinacea</i>)	325

Use a minimum of 3 varieties of tall fescue. Each variety should contain a minimum of 70% viable endophytes. Varieties should come from the following list: 2nd Millennium, Bonsai, Cayenne, Cochise III, Constitution, Covenant, Coyote II, Crossfire II, Dakota, Dynasty II, Escalade, Mustang 3, Rendition, SR 8600, Taos, Titan Ltd., Titanium or Tombstone or as approved by the Engineer and CDA.

Type 2 – Late Fall Seed Mix

Tall Fescue (<i>Festuca arundinacea</i>)	250
Perennial Ryegrass (<i>Lolium perenne</i>)	75

Use Tall Fescue blend of varieties listed in Schedule 1 and a blend of up to two cultivars of endophyte – containing Perennial Ryegrass.

Type 3 – Dormant Seed Mix

Tall Fescue (<i>Festuca arundinacea</i>)	300
Perennial Ryegrass (<i>Lolium perenne</i>)	75

Use Tall Fescue blend of varieties listed in Schedule 1 and a blend of up to two cultivars of endophyte – containing Perennial Ryegrass.

Type 4 – Swale/Ditch Seed Mix (See CDA Standard Detail 7-03-01)

<u>Type 1</u>	325
or	
<u>Type 2</u>	325
or	
<u>Type 3</u>	375
and	
Red Top (<i>Agrostis alba</i>)	10
Rough Bluegrass (<i>Poa trivialis</i>)	20

Use swale mix in areas where irregular inundation is expected. The area to be seeded shall include the swale/ditch banks up to an elevation that is two feet above the normal water elevation for the channel. For normally dry channels, this shall be measured from the channel invert. The Red Top and Rough Bluegrass should be over seeded at the specified rates over the Type 1 or Type 2 seed application depending on application date.

- D. The Contractor must store the Tall Fescue seed varieties in a cool dry place until planted to protect endophyte levels from high heat. The seed must not be stored in direct sunlight and must not be kept in a hot shed during summer.

25.02 LIME

- A. Lime, if required to adjust the soil pH, must be ground limestone containing not less than 85% of total carbonates, and must be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and

depth specified in the special provision on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime must contain at least 10% magnesium oxide.

- B. To determine if lime is required, the Contractor must perform 4 pH tests, located at least 50 feet apart, on the soil for each acre to be seeded. The average value of the test results must be the pH value for that acre tested. If the pH value is less than 5.5, the soil must be amended to raise the pH to the acceptable range. Lime requirement must be determined by soil test of the buffering capacity of the soil. Sufficient lime must be applied to raise soil pH to 6.5. Copies of the test results must be transmitted to the Engineer and CDA upon receipt by the Contractor.

25.03 FERTILIZER

- A. Fertilizer must be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphorus, and water-soluble potash. They must be applied at the rate and to the depth specified in this Specification, and must meet the specified requirements of the applicable state and federal laws. They must be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime will be permitted in mixed fertilizers.
- B. The fertilizers may be supplied as a finely-ground fertilizer soluble in water, suitable for application by power sprayers or for dry application as granules.

25.04 SOILS FOR REPAIRS

- A. The soil for fill and topsoiling of areas to be repaired must be at least of equal quality to the topsoil as outlined in Section T-905, Topsoiling.

25.05 MULCH WITH TACKIFIER

- A. Mulch must be a hydraulic mulch that meets the requirements of Article 1081.06 (a) (2) for a Light-Duty Hydraulic Mulch of the Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), latest edition; except that the minimum application rate must be 2,500 lbs/acre instead of 2,000 lbs/acre and as further modified herein.
- B. Mulch fiber must be colored green to contrast the area on which the mulch is being applied and must not stain concrete or other surfaces with which it comes in contact.
- C. Prior to use of the mulch, the Contractor must submit the following to the Engineer and CDA for review and approval:
 - 1. A notarized certification by the manufacturer that the mulch meets the requirements of these specifications.
 - 2. Property test results for the mulch including the C factor analytical results performed and certified by an approved accredited independent laboratory.

PART 26 CONSTRUCTION METHODS

26.01 ADVANCE PREPARATION AND CLEANUP

- A. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded must be raked or otherwise cleared of stones, sticks, stumps, and other debris which might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor must repair such damage. This may include filling gullies, smoothing irregularities, and repairing other work related damages.
- B. An area to be seeded must be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches as a result of grading operations and, if immediately prior to seeding, the top 3 inches of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.
- C. However, when the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds must first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches. Clods must be broken and the top 3 inches of soil must be worked into a satisfactory seedbed by disking, or appropriate means.
- D. Lime if required must be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime must be worked into the top 3 inches after which the seedbed must again be properly graded and dressed to a smooth finish.
- E. Apply a starter fertilizer, derived from quick release or mineral sources of nutrients, containing a minimum of 45 pounds of nitrogen per acre, 45 pounds of phosphorus (P_2O_5) per acre, and 45 pounds of potassium (K_2O) per acre immediately prior to the seed application described in paragraph 3.02. Additionally, apply a minimum of 70/lbs N/acre containing at least 75% SCU, XCU or nitroform type slow release nitrogen immediately prior to the application described in paragraph 3.02. These products can be applied separately or may be combined into a single application, providing a fertilizer formulator does the mixing. No on-site mixing will be allowed.

26.02 APPLICATION METHODS

- A. Seed Application: The Contractor must apply seed uniformly to the prepared seedbed in two directions perpendicular to each other, using one or more of the following methods as required:
 - 1. Class 1 – Apply seed uniformly, using a slit seeder, cultipacker or Brillion-type seeder. Roll with corrugated roller after seeding.
 - 2. Class 2 - Broadcast seed and cover with a light disk harrow or cultipacker

or other suitable equipment. Class 2 seed application to be done only with the approval of the Engineer and CDA.

3. Class 3 - Apply seed uniformly with a hydroseeder in a mixture not exceeding 220 pounds solids per 100 gallons of water. Class 3 seed application to be done only with the approval of the Engineer and CDA.

B. Mulch Application: After application of the seed using the approved methods above, mulch and mulch supertackifier must be applied immediately over the freshly seeded areas in opposing directions using the following rates:

1. Mulch 2500 lbs/acre (1250 lbs/acre per direction)
2. Mulch supertackifier per manufacturer recommendations.

Mulch must be applied in accordance with Article 251.03 (c), Method 3 of SSRBC, except that mulch supertackifier must be applied concurrently with mulch.

C. Spraying Equipment: The spraying equipment must have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank must also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

1. The unit must also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds per square inch. The pump must be mounted in a line which will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipe lines must be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator must have controls mounted so as to be accessible to the nozzle operator. There must be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.
2. The nozzle pipe must be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There must be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles must be supplied so that mixtures may be properly sprayed over distance varying from 20 feet to 100 feet. One must be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For ease of removal and cleaning, all nozzles must be connected to the nozzle pipe by means of quick-release couplings.
3. In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length must be provided to which the nozzles may be connected.

- D. Mixtures: Lime, if required, must be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds of lime must be added to and mixed with each 100 gallons of water. Mulch and mulch supertackifier must be mixed together and applied after seed application at the specified rates above but not more than 220 pounds combined solids per 100 gallons of water.
- E. All water used must be obtained from fresh water sources and must be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water must not be used at any time. The Contractor must identify to the Engineer and CDA all sources of water at least 2 weeks prior to use. The Engineer and CDA may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor must not use any water from any source which is disapproved by the Engineer and CDA following such tests.
- F. All mixtures must be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures must be used within 2 hours from the time they were mixed or they must be wasted and disposed of at locations acceptable to the Engineer and CDA.
- G. The mixtures must be applied by means of a high-pressure spray which will always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays will never be directed toward the ground in such a manner as might produce erosion or runoff.
- H. Particular care must be exercised to insure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with Specifications must be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets or paper or pans over the area at intervals and observing the quantity of material deposited thereon.

26.03 MAINTENANCE OF SEEDED AREAS

- A. The Contractor must protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Engineer and CDA. Surfaces gullied or otherwise damaged following seeding must be repaired by regrading and reseeding as directed. The Contractor must mow, water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work. Areas with excessive weed growth must be regraded and/or treated with an application of a select herbicide, at the approval of the Engineer and CDA, and reseeded to establish a satisfactory stand of grass. Watering will only be accomplished at night or as directed by the Engineer and CDA.
- B. When the seed application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Engineer and CDA. If at the time when the Contract has been otherwise completed it is not possible to make an adequate determination of the color, density, and uniformity of such stand of

grass, payment for the unaccepted portions of the areas seeded out of season will be withheld until such time as these requirements have been met.

26.04 TIME OF SEEDING

- A. The seeding and related operations must be performed during the following periods:
1. Standard seeding must occur between March 15 and September 15. Apply at specified rate and mix according to 2.01C (Type 1).
 2. Late fall seeding must occur between September 16 and October 15 according to 2.01C (Type 2).
 3. Late Fall seeding can be done between October 16 and November 14 at the direction of the Engineer and CDA (Type 2).
 4. Dormant seeding must occur between June 15 and August 15 at the discretion of the Engineer and CDA and between November 15 and December 31 or until the ground becomes frozen according to 2.01C (Type 3).
 5. Seeding must be done immediately upon completion of work in a given area. The outlet channel, peripheral drain and other areas of work completed during the course of the Contract must be permanently seeded during the next seeding period after completion. If it is more than 45 days until the period, the Contractor must use temporary protection measures to prevent soil erosion, and they will be acceptable to the Engineer and CDA.
 6. No seeding may occur between October 16 and November 14 (except as directed by the Engineer and CDA in Section 3.04.A.3) and between January 1 and March 14.

PART 27 METHOD OF MEASUREMENT

4.01 N/A

PART 5 BASIS OF PAYMENT

5.01 Payment for seeding will be included in the Contract unit price for the following items; handholes, ductbank, ALSF-2 and MALSR Lights.

TOPSOILING FOR FAA RELOCATIONS (SECTION T-905)

PART 28 DESCRIPTION

28.01 GENERAL

- A. This item must consist of preparing the ground surface for topsoil application, placing machine pulverized topsoil obtained from on site unclassified excavation or from approved sources off the site at the Contractor's option, and spreading the topsoil on prepared areas in accordance with this Specification at the locations shown on the Drawings or as determined by the Engineer and CDA. The work under this Section is subject to the requirements of the Contract Documents.

PART 29 MATERIALS

29.01 TOPSOIL

- A. Topsoil must be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it must be reasonably free from subsoil and stumps, roots, brush, stones, clay lumps, sticks, debris, or similar objects of one inch many dimension and larger. The topsoil must be thoroughly pulverized through a topsoil pulverizer / screen machine before placement. Brush and other vegetation which will not be incorporated with the soil during handling operations must be cut and removed. Ordinary sods and herbaceous growth such as grass and weeds are not to be removed but must be thoroughly broken up and intermixed with the soil during handling and pulverizing operations. The topsoil or soil mixture, unless otherwise specified or approved, must have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content must be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction) AASHTO T194. There must be not less than 20% nor more than 80% of the material passing the 200 mesh sieve as determined by the wash test in accordance with AASHTO T 11.
- B. Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above Specifications. Topsoil must be pulverized prior to application.

29.02 INSPECTION AND TESTS

- A. At least 21 days prior to placement, the Contractor must notify the Engineer and CDA of the source of topsoil he proposes to furnish whether from strippings or grading on site, supplemented from sources off site of the Project area, or totally from an off site source. When directed by the Engineer and CDA, the topsoil must be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. The Contractor must take a minimum of one representative soil sample from three (3) locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in Paragraph 2.01.

PART 30 CONSTRUCTION METHODS

30.01 GENERAL

- A. Areas to be topsoiled must be as shown on the Drawings or designated by the Engineer and CDA. Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil and for the handling and placing of all required materials must be on hand, in good condition, and approved by the Engineer and CDA before the various operations are started.

30.02 PREPARING THE GROUND SURFACE

- A. Immediately prior to dumping and spreading the topsoil on any area, the surface must be loosened by discs or spike-tooth harrows, or by other means acceptable to the Engineer and CDA, to a minimum depth of one (1) inch to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled must be cleared of all stones larger than 1 inch in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the Plans, which are too compact to respond to these operations, must receive special scarification.
- B. Grades on the area to be topsoiled, which have been established by others as shown on the Plans, must be maintained in a true and even condition. Where grades have not been established, the areas must be smooth-graded and the surface left at the prescribed grades in an even and properly compacted condition to prevent, insofar as practical, the formation of low places or pockets where water will stand.

30.03 OBTAINING TOPSOIL

- A. Topsoil, whether obtained on-site or off-site, must be pulverized prior to installation in the Project.
- B. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, sticks, rubbish or stones found on such areas, which may interfere with subsequent operations, must be removed using methods acceptable to the Engineer and CDA. Heavy sod or other cover, which cannot be incorporated into the topsoil by pulverizing must be removed.
- C. The topsoil must be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the Engineer and CDA. Any topsoil stockpiled by the Contractor must be rehandled and placed without additional compensation. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor must be graded if required and put into a condition acceptable for seeding.
- D. When suitable topsoil is secured off the Airport site, the Contractor must locate and obtain the supply, subject to the approval of the Engineer and CDA. The Contractor must notify the Engineer and CDA sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor must remove the topsoil from approved areas and to the depth as directed. The topsoil must be hauled to the site of the work and pulverized per

Paragraph 2.01.A and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled must be rehandled and placed without additional compensation.

30.04 PLACING TOPSOIL

- A. The topsoil must be evenly spread on the prepared areas to a uniform depth of 4 inches after compaction, unless otherwise shown on the Plans. Spreading must not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading must be carried on so that turving operations can proceed with a minimum of soil preparation or tilling.
- B. After spreading, any large, stiff clods and hard lumps must be broken with a pulverizer or by other effective means, and all stones or rocks (1 inch or more in diameter), roots, sticks, litter, or any foreign matter must be raked up and disposed of by the Contractor. After spreading is completed, the topsoil must be satisfactorily compacted by rolling with a cultipacker or by other means acceptable to the Engineer and CDA. The compacted topsoil surface must conform to the required lines, grades, and cross sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil must be promptly removed.

PART 31 METHOD OF MEASUREMENT

31.01 MEASUREMENTS

N/A

PART 32 BASIS OF PAYMENT

32.01 PAYMENTS

Payment for topsoiling will be included in the Contract unit price for the following items; handholes, ductbank, ALSF-2 and MALSR light towers.

SITE DEMOLITION FOR FAA RELOCATIONS (SECTION X-100)

PART 33 DESCRIPTION

33.01 GENERAL

- A. This Section includes all the work required to demolish and remove existing surface and underground structures and utilities indicated on the Plans. Structures include but are not limited to existing manholes, inlets, catch basins, and pipes associated with utilities. Electrical utility removal include manholes, ducts, and light bases with and without lights as shown in the Plans.
- B. Contractor must conform to the Building Code of the City of Chicago for Demolition of Structures, safety of adjacent structures and dust control.
- C. Contractor must notify affected utility companies before starting work and comply with their requirements for protection and or termination of facilities.
- D. All equipment to be used on the Project must comply with the height restrictions of the FAA 7460 permit.
- E. Blasting will not be permitted.

PART 34 MATERIALS

34.01 GRANULAR BACKFILL

- A. Granular backfill must conform to IDOT Standard Specification, Section 209 or 311, Type CA-6. Recycled or virgin is allowed.

PART 35 CONSTRUCTION METHODS

35.01 DEMOLITION REQUIREMENTS

- A. Contractor must:
 - 1. Conduct demolition operations to minimize interference with adjacent structures, utilities or appurtenances.
 - 2. Cease operations immediately if adjacent structures appear in danger. Notify the Engineer, CDA, and FAA. Do not resume operations until directed.
 - 3. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose. If water is to be supplied from a fire hydrant, then backflow preventers must be used. Water trucks may also be needed.

35.02 EXISTING UTILITIES

- A. Contractor must demolish and completely remove existing utilities where indicated. Contractor must cap and abandon in place utilities where indicated. Utilities must include, but not limited to, hydrants, underground piping, conduit and cables, mechanical and electrical systems indicated to be removed. Contractor must coordinate with existing utility owners for shut-off of services if

lines are active and for cut-off and sealing or capping (Commonwealth Edison Co., Ameritech, Peoples Gas, etc).

35.03 CLOSING ABANDONED UNDERGROUND UTILITIES

- A. Contractor must permanently close open ends of abandoned underground utilities indicated to remain with the following materials to withstand backfill pressures which may result after closing.
- B. Close open ends of conduit and pipe with caps, plugs or other suitable method for the type and size of material as acceptable to the Engineer, CDA, and FAA. Wooden caps or plugs are not acceptable.
- C. Close open ends of concrete and masonry utilities 2'-0" diameter or smaller with not less than 8 inches thick concrete bulkheads, constructed to completely close the openings.
- D. Submit details for closure of concrete or masonry utilities larger than 2'-0" to the Engineer, CDA, and FAA for review.

35.04 REMOVAL OF ABANDONED UNDERGROUND UTILITIES

- A. Contractor must remove underground utility lines and structures indicated to be removed in their entirety. Backfill must be placed in layers not to exceed 6" and compacted to 95% of the maximum density determined by ASTM D 1557.

35.05 FILL

- A. All areas excavated below the elevation indicated on the Drawings such as former basements, manholes and like areas must be filled with granular backfill to the indicated elevation.

PART 36 METHOD OF MEASUREMENT

36.01 MEASUREMENTS

- A. The work covered under this Section will not be measured for payment but is included in the Contract unit price for the following pay items associated with the work, as listed in special provisions MALSR Modifications and Foundations (Section 13100)and ALSF-2 Electrical (Section 16630) respectively:
 - 1. INSTALL NEW MALSR MG-30 LIGHT TOWER – COMPLETE
 - 2. INSTALL TEMPORARY ALSF-2 MG-20 LIGHT TOWER - COMPLETE
- B. No separate payment will be made for granular backfill material used to fill removed utility lines and structures.

PART 37 BASIS OF PAYMENT

37.01 PAYMENTS

- A. The work covered under this Section will not be paid for separately but is included in the Contract unit price for the following pay items associated with the work, as listed in special provisions MALSR Modifications and Foundations (Section 13100)and ALSF-2 Electrical (Section 16630) respectively:

1. INSTALL NEW MALSR MG-30 LIGHT TOWER – COMPLETE
2. INSTALL TEMPORARY ALSF-2 MG-20 LIGHT TOWER -
COMPLETE