ADDENDUM NO. 1

GMIA PERIMETER ROAD BRIDGE OVER HOWELL AVENUE PROJECT **PROJECT NO. A163-11602**

OFFICIAL NOTICE NO. 6736

GENERAL MITCHELL INTERNATIONAL AIRPORT
Milwaukee County, Wisconsin

Prepared By: MILWAUKEE COUNTY DEPARTMENT OF ADMINISTRATIVE SERVICES
ARCHITECTURE ENGINEERING & ENVIRONMENTAL SERVICES DIVISION
County-City Campus – Telephone 414-278-4861
2711 West Wells Street

DATE OF ADDENDUM: July 19, 2012

BIDS CLOSE: 2:00 P.M., WEDNESDAY August 1, 2012

TO ALL BIDDERS:

Each bidder shall read this Addendum in its entirety to determine to what extent his proposal and the contract conditions will be affected. This Addendum to the Contract Documents is issued to modify, explain, or correct the original documents and is hereby made part of the Contract Documents.

RECEIPT – Sign the following receipt and attach to submitted Proposal Form.

Receipt of Addendum No. 1, consisting of _one hundred seventy-nine_ (179) pages, for **GMIA Perimeter Road Bridge Over Howell Avenue Project,** Official Notice No. 6736, at General Mitchell International Airport, Milwaukee, Wisconsin, dated August 1, 2012 is acknowledged.

Date _____ Firm _____

Per _____ Address _____

CHANGES TO: PROJECT MANUAL

Cover Page.

1. Project Manager: Darrell Berry, Mead & Hunt, Inc., change telephone number from (414) 935-4247 to (414) 935-4254.
2. DBE Participation Compliance: Delete Freida Webb and replace with Mark Phillips.

Section 1, Official Notice.

3. Under Bid Documents, remove the last sentence of the second paragraph so the paragraph reads, 'Bidding documents may be purchased at the Architecture, Engineering and Environmental Services Division, 2711 West Wells Street, 2nd Floor, for $100.00 per set using Visa® or MasterCard®.'

Section 5, Bid Schedule.

4. Delete this section and replace with the attached revised Section 5 Bid Schedule (attached, 24 pages).

Section 25, Special Provisions.

5. Delete this section and replace with the attached revised Special Provisions (attached, 23 pages).

Section 26, Standard Specifications.

6. Delete this section and replace with the attached revised Standard Specifications (attached, 127 pages)

CHANGES TO: PLANS

7. Remove Sheet G-002, Sheet Index, and replace with revised Sheet G-002 (attached).
8. Remove Sheet G-003, Project Overview Plan, and replace with revised Sheet G-003 (attached).
9. Remove Sheet C-061, Project Quantity Tables, and replace with revised Sheet C-061 (attached).
10. Remove Sheet G-083, Miscellaneous Quantities and replace with revised Sheet G-083 (attached).
11. Remove Sheet C-051, Demolition Plan, and replace with revised Sheet C-051 (attached).
12. Remove Sheet C-052, Temporary Construction Road Plan and Profile, and replace with revised Sheet C-052 (attached).
13. Remove Sheet C-202, Perimeter Road Plan and Profile, and replace with revised Sheet C-202 (attached).
14. Remove Sheet C-203, Citation Way Plan and Profile, and replace with revised Sheet C-203 (attached).
15. Remove Sheet C-204, Howell Avenue Plan and Profile, and replace with revised Sheet C-204 (attached).
16. Remove Sheet C-206, Median Curb Details Howell Ave, and replace with revised Sheet C-206 (attached).
17. Remove Sheet C-301, Proposed Typical Sections and replace with revised Sheet C-301 (attached).
18. Remove Sheet C-302, Proposed Typical Sections and replace with revised Sheet C-302 (attached).
19. Add Sheet C-402, Fire Alarm Cable Plan (attached).
20. Remove Sheet C-443, Citation Way Storm Drain Plan and Profile, and replace with revised sheet C-443 (attached).
21. Remove Sheet C-444, Howell Avenue Storm Drain Plan and Profile and replace with revised Sheet C-444 (attached).
22. Remove Sheet C-504, Typical Details and replace with revised Sheet C-504 (attached).
23. Add Sheet C-505, Concrete Curb, Concrete Curb & Gutter C-505 (attached).
24. Add Sheet C-506, Concrete Pavement C-506 (attached).
25. Add Sheet C-507, Concrete Pavement C-507 (attached).
26. Add Sheet C-508, Typical Installation of Permanent Type II Signs on Single Posts C-508 (attached).
27. Add Sheet C-509, Typical Installation of Type II Signs on Multiple Posts C-509 (attached).

28. Add Sheet C-510, Attachment of Signs to Posts C-510 (attached).
29. Add Sheet C-511, Tubular Steel Sign Posts C-511 (attached).
30. Add Sheet C-512, 4x6 Wood Post Modifications C-512 (attached).
31. Add Sheet C-513, Standard Layout of Aluminum Sign Blanks C-513 (attached).
32. Add Sheet C-514, Standard Layout of Aluminum Sign Blanks C-514 (attached).
33. Add Sheet C-515, Standard Layout of Aluminum Sign Blanks C-515 (attached).
34. Add Sheet C-516, Signing and Sign Marking for Two Lane Bridges C-516 (attached).
35. Add Sheet C-517, Pavement Marking (Mainline) C-517 (attached).
36. Add Sheet C-518, Pavement Marking (Islands, Stop Line and Sign Cross Walk) C-518 (attached).
37. Add Sheet C-519, Pavement Marking Words C-519 (attached).
38. Add Sheet C-520, Pavement Marking Arrows C-520 (attached).
39. Remove Sheet C-601, Fence Plan, and replace with revised Sheet C-601 (attached).
40. Remove Sheet C-650, Traffic Control & Construction Staging, and replace with revised Sheet C-650 (attached).
41. Remove Sheet C-651, Traffic Control & Construction Staging, and replace with revised Sheet C-651 (attached).
42. Remove Sheet C-652, Traffic Control & Construction Staging, and replace with revised Sheet C-652 (attached).
43. Remove Sheet C-653, Traffic Control & Construction Staging, and replace with revised Sheet C-653 (attached).
44. Remove Sheet C-654, Traffic Control & Construction Staging, and replace with revised Sheet C-654 (attached).
45. Remove Sheet C-655, Traffic Control & Construction Staging, and replace with revised Sheet C-655 (attached).
46. Remove Sheet C-656, Traffic Control & Construction Staging, and replace with revised Sheet C-656 (attached).
47. Remove Sheet C-657, Traffic Control & Construction Staging, and replace with revised Sheet C-657 (attached).
48. Remove Sheet C-658, Traffic Control & Construction Staging, and replace with revised Sheet C-658 (attached).
49. Remove Sheet C-659, Traffic Control & Construction Staging, and replace with revised Sheet C-659 (attached).
50. Remove Sheet C-660, Traffic Control & Construction Staging, and replace with revised Sheet C-660 (attached).
51. Remove Sheet C-661, Traffic Control & Construction Staging, and replace with revised Sheet C-660 (attached).
52. Remove Sheet C-662, Traffic Control & Construction Staging, and replace with revised Sheet C-662 (attached).
53. Remove Sheet C-663, Traffic Control & Construction Staging, and replace with revised Sheet C-663 (attached).
54. Remove Sheet C-664, Traffic Control & Construction Staging, and replace with revised Sheet C-664 (attached).
55. Remove Sheet C-665, Traffic Control & Construction Staging, and replace with revised Sheet C-665 (attached).
56. Remove Sheet C-666, Traffic Control & Construction Staging, and replace with revised Sheet C-666 (attached).
57. Remove Sheet C-667, Traffic Control & Construction Staging, and replace with revised Sheet C-667 (attached).
58. Remove Sheet C-668, Traffic Control & Construction Staging, and replace with revised Sheet C-668 (attached).
59. Remove Sheet C-669, Traffic Control & Construction Staging, and replace with revised Sheet C-669 (attached).
60. Remove Sheet C-670, Traffic Control & Construction Staging, and replace with revised Sheet C-670 (attached).
61. Remove Sheet C-671, Traffic Control & Construction Staging, and replace with revised Sheet C-671 (attached).

62. Remove Sheet C-672, Traffic Control & Construction Staging, and replace with revised Sheet C-672 (attached).
63. Remove Sheet C-673, Traffic Control & Construction Staging, and replace with revised Sheet C-673 (attached).
64. Remove Sheet C-674, Traffic Control & Construction Staging, and replace with revised Sheet C-674 (attached).
65. Remove Sheet C-675, Traffic Control & Construction Staging, and replace with revised Sheet C-675 (attached).
66. Add Sheet C-676, Traffic Control & Construction Staging (attached).
67. Remove Sheet C-803, Permanent Signing, and replace with revised Sheet C-803 (attached).
68. Remove Sheet C-912, Cross Sections Howell Ave., and replace with revised Sheet C-912 (attached).
69. Remove Sheet C-913, Cross Sections Howell Ave., and replace with revised Sheet C-913 (attached).
70. Remove Sheet S-101, General Plan and Elevation, and replace with revised Sheet S-101 (attached).
71. Remove Sheet S-102, Cross Sections and General notes, and replace with revised Sheet S-102 (attached).
72. Remove Sheet S-103, Quantities and Profile Grade Lines, and replace with revised Sheet S-103 (attached).
73. Remove Sheet S-105, West Abutment, and replace with revised Sheet S-105 (attached).
74. Remove Sheet S-106, East Abutment, and replace with revised Sheet S-106 (attached).
75. Remove Sheet S-107, Abutment Details, and replace with revised Sheet S-107 (attached).
76. Remove Sheet S-201, General Plan and Elevation, and replace with revised Sheet S-201 (attached).
77. Remove Sheet S-202, MSE Wall Typical Sections, and replace with revised Sheet S-202 (attached).
78. Remove Sheet S-203, MSE Wall Design Data, and replace with revised Sheet S-203 (attached).
79. Remove Sheet S-209, Aesthetic Details and Box Culvert, and replace with revised Sheet S-209 (attached).
80. Add Sheet S-210, Prestressed Precast Panel Details (attached).
81. Remove Sheet S-301, General Plan and Elevation, and replace with revised Sheet S-301 (attached).
82. Remove Sheet S-302, MSE Wall Typical Sections, and replace with revised Sheet S-302 (attached).
83. Remove Sheet S-303, MSE Wall Design Data, and replace with revised Sheet S-303 (attached).
84. Add Sheet S-310, Prestressed Precast Panel Details (attached).

PROJECT MANUAL

FOR

GMIA PERIMETER ROAD BRIDGE OVER HOWELL AVENUE PROJECT

Project No. A163-11602

AT

GENERAL MITCHELL INTERNATIONAL AIRPORT
5300 SOUTH HOWELL AVENUE
MILWAUKEE WISCONSIN 53207

Official Notice No. 6736

Date: July 11, 2012

NOTE: The DBD, EEOC, and wage rate requirements have changed from preceding contracts.

Project Manager:	Darrell Berry, Mead & Hunt, Inc.	(414) 935-4254
DBE Participation Compliance:	Mark Phillips	(414) 278-5104
EEO Compliance:	Paul Grant	(414) 278-4292
Diggers Hotline:		(800) 242-8511

Bidders are requested to quote unit prices and make extensions for each item on the following Bid Schedule, in accordance with the proposal conditions, specifications, drawings, exhibits, and standard forms listed herein and made a part hereof. Unit prices so quoted herein shall govern in all cases.

BIDDER'S ATTENTION IS SPECIFICALLY DIRECTED to the fact that the items listed herein constitute one complete bid schedule comprising a single job unit, and the price on all items listed must be quoted in order to qualify as an acceptable bid.

BID SCHEDULE - BASE BID
GMIA - Perimeter Road Bridge Over Howell Avenue
Perimeter Road
Project No. WA163-11602

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
1	MOBILIZATION Item M-1 Unit Price per Lump Sum in Writing	1	LS			
2	8" POTABLE WATER MAIN Item 105.001.01 Unit Price per Linear Foot in Writing	481	LF			
3	10" RCP SANITARY SEWER LINE Item 105.001.02 Unit Price per Linear Foot in Writing	502	LF			
4	REMOVING PAVEMENT Item 204.0100 Unit Price per Square Yard in Writing	449	SY			
5	REMOVING CURB AND GUTTER Item 204.0150 Unit Price per Linear Foot in Writing	567	LF			
6	REMOVING CURB HEAD Item 204.0130 Unit Price per Linear Foot in Writing	65	LF			
7	COMMON EXCAVATION Item 205.0100 Unit Price per Cubic Yard in Writing	8,590	CY			
8	EXCAVATION FOR STRUCTURES BRIDGES B-40-772 Item 206.1000 Unit Price per Lump Sum in Writing	1	LS			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
9	TEMPORARY SHORING Item 206.6000.S Unit Price per Linear Foot in Writing	765	SF			
10	BORROW Item 208.0100 Unit Price per Cubic Yard in Writing	15,723	CY			
11	BACKFILL GRANULAR Item 209.0100 Unit Price per Cubic Yard in Writing	8,580	CY			
12	FINISHING ROADWAY Item 213.0100 Unit Price per Each in Writing	1	EACH			
13	OBLITERATE OLD ROAD Item 214.0100 Unit Price per Station in Writing	6	STA			
14	BASE AGGREGATE DENSE 3/4 INCH Item 305.0110 Unit Price per TON in Writing	547	TON			
15	BASE AGGREGATE DENSE 1 1/4 INCH Item 305.0120 Unit Price per TON in Writing	2,241	TON			
16	CONCRETE PAVEMENT 9-INCH Item 415.0090 Unit Price per Square Yard in Writing	604	SY			
17	CONCRETE PAVEMENT 10-INCH Item 415.0100 Unit Price per Square Yard in Writing	1,619	SY			
18	DRILLED DOWEL BARS Item 416.0620 Unit Price per Each in Writing	48	EA			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
19	ASPHALTIC MATERIAL PG58-28 Item 455.0105 Unit Price per Ton in Writing	99	TON			
20	CONCRETRE MASONRY BRIDGES Item 502.0100 Unit Price per Cubic Yard in Writing	110	CY			
21	BAR STEEL REINFORCEMENT HS BRIDGES Item 505.0405 Unit Price per Pound in Writing	3,080	LB			
22	BAR STEEL REINFORCEMENT HS COATED BRIDGES Item 505.0605 Unit Price per Pound in Writing	16,600	LB			
23	CONCRETE STAINING STRUCTURE Item 517.1010.S Unit Price per Square Foot in Writing	1,380	SF			
24	APRON END WALLS FOR CULVERT PIPE 12-INCH DIA Item 520.1012 Unit Price per Each in Writing	1	EACH			
25	CULVERT PIPE TEMPORARY 24-INCH DIA Item 520.4024 Unit Price per Linear Foot in Writing	74	LF			
26	WALL WIRE FACED MECHANICALLY STABILIZED EARTH Item 532.0700.S Unit Price per Square Foot in Writing	33,890	SF			
27	PILING STEEL HP 12-INCH X 53 LB Item 550.1120.S Unit Price per Linear Foot in Writing	3,825	LF			
28	CONCRETE CURB & GUTTER 30-INCH, TYPE A Item 601.0409 Unit Price per Linear Foot in Writing	1,824	LF			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
29	CONCRETE SIDE WALK 5-INCH Item 602.0410 Unit Price per Square Foot in Writing	280	SF			
30	RIP-RAP MEDIUM Item 606.0200 Unit Price per Cubic Yard in Writing	1	CY			
31	STORM SEWER PIPE REINFORCED CONCRETE CLASS III 12-INCH Item 608.0312 Unit Price per Linear Foot in Writing	495	LF			
32	CATCH BASINS TYPE 2 Item 611.0103 Unit Price per Each in Writing	5	EACH			
33	MANHOLES TYPE 2 Item 611.0205 Unit Price per Each in Writing	2	EACH			
34	MANHOLE COVERS TYPE J-SPECIAL Item 611.0535 Unit Price per Each in Writing	2	EACH			
35	STEEL THRIE BEAM STRUCTURE APPROACH Item 614.0250 Unit Price per Linear Foot in Writing	32	LF			
36	STEEL PLATE BEAM GUARD CLASS A Item 614.0305 Unit Price per Linear Foot in Writing	100	LF			
37	CRASH CUSHIONS PERMANENT Item 614.0800 Unit Price per Each in Writing	2	EA			
38	EROSION BALES Item 628.1104 Unit Price per Each in Writing	3	EACH			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
39	SILT FENCE Item 628.1504 Unit Price per Linear Foot in Writing	2,531	LF			
40	SILT FENCE MAINTENANCE Item 628.1520 Unit Price per Linear Foot in Writing	2,531	LF			
41	MOBILIZATIONS EROSION CONTROL Item 628.1905 Unit Price per Each in Writing	1	EACH			
42	MOBILIZATIONS EMERGENCY EROSION CONTROL Item 628.1910 Unit Price per Each in Writing	1	EA			
43	EROSION MAT CLASS I TYPE B Item 628.2004 Unit Price per Square Yard in Writing	15,150	SY			
44	INLET PROTECTION TYPE A Item 628.7005 Unit Price per Each in Writing	15	EACH			
45	INLET PROTECTION TYPE B Item 628.7010 Unit Price per Each in Writing	3	EACH			
46	INLET PROTECTION TYPE C Item 628.7015 Unit Price per Each in Writing	12	EACH			
47	TEMPORARY DITCH CHECKS Item 628.7504 Unit Price per Linear Foot in Writing	15	LF			
48	TRACKING PADS Item 628.765 Unit Price per Each in Writing	1	EA			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
49	SOD LAWN Item 631.1000 Unit Price per Square Yard in Writing	20	SY			
50	MOVING FIRE SIGNAL Item 638.2103 Unit Price per Lump Sum in Writing	1	LS			
51	TRAFFIC CONTROL Item 643.0100 Unit Price per Each in Writing	1	EACH			
52	TRAFFIC CONTROL SURVEILLANCE AND MAINTENANCE Item 643.0200 Unit Price per Each in Writing	1	EACH			
53	TRAFFIC CONTROL DRUMS Item 643.0300 Unit Price per DAY in Writing	9,266	DAYS			
54	TRAFFIC CONTROL BARRICADES TYPE III Item 643.0420 Unit Price per DAY in Writing	184	DAYS			
55	TRAFFIC CONTROL WARNING LIGHTS TYPE A Item 643.0705 Unit Price per DAY in Writing	368	DAYS			
56	TRAFFIC CONTROL WARNING LIGHTS TYPE C Item 643.0715 Unit Price per DAY in Writing	3,572	DAYS			
57	TRAFFIC CONTROL ARROW BOARDS Item 643.0800 Unit Price per DAY in Writing	368	DAYS			
58	TRAFFIC CONTROL SIGNS Item 643.0900 Unit Price per DAY in Writing	2,116	DAYS			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
59	TRAFFIC CONTROL SIGNS PORTABLE CHANGEABLE MESSAGE Item 643.1050.S Unit Price per DAY in Writing	110	DAYS			
60	PAVEMENT MARKING EPOXY 4-INCH Item 646.0106 Unit Price per Linear Foot in Writing	4,249	LF			
61	PAVEMENT MARKING EPOXY 8-INCH Item 646.0126 Unit Price per Linear Foot in Writing	107	LF			
62	CONSTRUCTION STAKING CURB GUTTER CURB & GUTTER Item 650.5500 Unit Price per Linear Foot in Writing	179	LF			
63	CONSTRUCTION STAKING SUPPLEMENTAL CONTROL Item 650.9910 Unit Price per Lump Sum in Writing	1	LS			
64	CONDUIT RIGID NONMETALIC SCH 40 1-INCH Item 652.0210 Unit Price per Linear Foot in Writing	21	LF			
65	CONDUIT RIGID NONMETALIC SCH 40 2 1/2-INCH Item 652.0230 Unit Price per Linear Foot in Writing	22	LF			
66	LUMINAIRES UNDERDECK 150 WATTS Item 659.0215 Unit Price per Each in Writing	2	EACH			
67	SAWING CONCRETE Item 690.0250 Unit Price per Linear Foot in Writing	225	LF			
68	DIRECTIONAL BORE 2W-2" SCH 80 Item D-555-8.1 Unit Price per Linear Foot in Writing	315	LF			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
69	REMOVE FENCE Item F162-5.1 Unit Price per Linear Foot in Writing	662	LF			
70	FENCE CHAIN LINK 12-FT Item F162-5.2 Unit Price per Linear Foot in Writing	1,950	LF			
71	GATES CHAIN LINK 20-FT Item F162-5.3 Unit Price per Each in Writing	1	EA			
72	2W-2" SCH 40 TYPE 1 Item L-110-5.1 Unit Price per Linear Foot in Writing	1,025	LF			
73	2W-4" SCH 40 PVC TYPE 1 Item L-110-5.2 Unit Price per Linear Foot in Writing	1,013	LF			
74	HANDHOLDS (SPRING ASSIST LIDS) Item L-115-5.1 Unit Price per Each in Writing	3	EACH			
75	CORE INTO EXISTING MANHOLE Item L-115-5.2 Unit Price per Each in Writing	1	EACH			
76	#6 COUNTERPOSE Item L-115-5.3 Unit Price per Linear Foot in Writing	1,513	LF			
77	LOCATE AND PROTECT EXISTING L-110-5.1206.1000 Unit Price per Lump Sum in Writing	1	LS			
78	6" STRAND SM FOC Item L-152-5.1 Unit Price per Linear Foot in Writing	1,507	LF			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
79	CORE INTO EXISTING HANDHOLE Item L-115-5.2 Unit Price per Each in Writing	4	EACH			
80	25 PAIR CONTROL CABLE Item L-153-5.1 Unit Price per Linear Foot in Writing	2,980	LF			
81	#1/0 COUNTERPOSE Item L-153-5.2 Unit Price per Linear Foot in Writing	525	LF			
82	REMOVAL OF EXISTING (4) 25 PR CABLE Item L-153-5.3 Unit Price per Linear Foot in Writing	475	LF			
83	EQUIPMENT RACK L-155-5.1 Unit Price per Lump Sum in Writing	1	LS			
84	HANDHOLE (LOCKABLE) Item L-155-5.2 Unit Price per Each in Writing	10	EACH			
85	CARD READER ISLAND Item L-156-5.1 Unit Price per Each in Writing	2	EACH			
86	AREA LIGHTING Item L-156-5.2 Unit Price per Each in Writing	2	EACH			
87	SECURITY CAMERA Item L-156-5.3 Unit Price per Each in Writing	1	EACH			
88	GATE OPERATORS L-160 Unit Price per Lump Sum in Writing	1	LS			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
89	JUNCTION BOXES 8X8X4-INCH Item SPV.0060.01 Unit Price per Each in Writing	2	EACH			
90	JUNCTION BOXES 12X12X8-INCH Item SPV.0060.02 Unit Price per Each in Writing	1	EACH			
91	PRECAST CONCRETE BOX CULVERT 6-FT X 6-FT Item SPV.0090.03 Unit Price per Linear Foot in Writing	54	LF			
92	TEMPORARY CHAIN LINK FENCE, 8-FT Item X162-5.1 Unit Price per Linear Foot in Writing	4,170	LF			
93	TEMPORARY GATE CHAIN LINK FENCE, 30-FT X162-5.2 Unit Price per Each in Writing	3	EACH			
94	TEMPORARY FENCE - DITCH CROSSING Item X162-5.3 Unit Price per Linear Foot in Writing	83	LF			
95	ABANDON FIRE ALARM CONDUIT Item 204.0101 Unit Price per Linear Foot in Writing	520	LF			
	BASE BID SUBTOTAL IN FIGURES					
96	MISCELLANEOUS ALLOWANCE Unit Price per Lump Sum in Writing	1 FIFTY THOUSAND	LS			
97	UTILITY RELOCATION ALLOWANCE Unit Price per Lump Sum in Writing	1 ONE HUNDRED AND SEVENTY SIX THOUSAND	LS			
	BASE BID GRAND TOTAL IN FIGURES					

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount	
					Dollars	Cents
	BASE BID GRAND TOTAL IN WRITING					

Bidders are requested to quote unit prices and make extensions for each item on the following Bid Schedule, in accordance with the proposal conditions, specifications, drawings, exhibits, and standard forms listed herein and made a part hereof. Unit prices so quoted herein shall govern in all cases.

BIDDER'S ATTENTION IS SPECIFICALLY DIRECTED to the fact that the items listed herein constitute one complete bid schedule comprising a single job unit, and the price on all items listed must be quoted in order to qualify as an acceptable bid.

BID SCHEDULE - ALT 1
GMIA - Perimeter Road Bridge Over Howell Avenue
Perimeter Road
Project No. WA163-11602

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
1	MOBILIZATION Item M-1 Unit Price per Lump Sum in Writing	1	LS			
2	BACKFILL STRUCTURE Item 210.0100 Unit Price per Cubic Yard in Writing	360	CY			
3	FINISHING ROADWAY Item 213.0100 Unit Price per Each in Writing	1	EACH			
4	CONCRETRE MASONRY BRIDGES Item 502.0100 Unit Price per Cubic Yard in Writing	493	CY			
5	PROTECTIVE SURFACE TREATMENT Item 502.3200 Unit Price per Square Yard in Writing	1,310	SY			
6	PRESTRESSED GIRDER TYPE I 45W-INCH Item 503.0146 Unit Price per Linear Foot in Writing	1,894	LF			
7	BAR STEEL REINFORCEMENT HS BRIDGES Item 505.0405 Unit Price per Pound in Writing	4,480	LB			
8	BAR STEEL REINFORCEMENT HS COATED BRIDGES Item 505.0605 Unit Price per Pound in Writing	126,580	LB			
9	BEARING PADS ELASTOMERIC NON-LAMINATED	32	EA			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
	Item 506.2605 Unit Price per Each in Writing					
10	STEEL DIAPHRAGMS B-40-772 Item 506.400 Unit Price per Each in Writing	28	EA			
11	RUBBERIZED MEMBRANE WATERPROOFING Item 516.0500 Unit Price per Square Yard in Writing	16	SY			
12	CONCRETE STAINING STRUCTURE Item 517.1010.S Unit Price per Square Foot in Writing	11,450	SF			
13	SLOPE PAVING CONCRETE Item 604.0400 Unit Price per Square Yard in Writing	669	SY			
14	RIP-RAP MEDIUM Item 606.0200 Unit Price per Cubic Yard in Writing	7	CY			
15	PIPE UNDERDRAIN WRAPPED 6-INCH Item 612.0406 Unit Price per Linear Foot in Writing	88	LF			
16	EROSION BALES Item 628.1104 Unit Price per Each in Writing	3	EACH			
17	SILT FENCE Item 628.1504 Unit Price per Linear Foot in Writing	2,098	LF			
18	SILT FENCE MAINTENANCE Item 628.1520 Unit Price per Linear Foot in Writing	2,098	LF			
19	MOBILIZATIONS EROSION CONTROL	1	EACH			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
	Item 628.1905 Unit Price per Each in Writing					
20	MOBILIZATIONS EMERGENCY EROSION CONTROL Item 628.1910 Unit Price per Each in Writing	1	EA			
21	EROSION MAT CLASS 1 TYPE B Item 628.2004 Unit Price per Square Yard in Writing	7,350	SY			
22	INLET PROTECTION TYPE A Item 628.7005 Unit Price per Each in Writing	4	EACH			
23	INLET PROTECTION TYPE C Item 628.7015 Unit Price per Each in Writing	4	EACH			
24	TRAFFIC CONTROL Item 643.0100 Unit Price per Each in Writing	1	EACH			
25	TC SURVEILLANCE AND MAINTENANCE Item 643.0200 Unit Price per Each in Writing	1	EACH			
26	TRAFFIC CONTROL DRUMS Item 643.0300 Unit Price per DAY in Writing	2,734	DAYS			
27	TRAFFIC CONTROL BARRICADES TYPE III Item 643.0420 Unit Price per DAY in Writing	65	DAYS			
28	TRAFFIC CONTROL WARNING LIGHTS TYPE A Item 643.0705 Unit Price per DAY in Writing	131	DAYS			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
29	TRAFFIC CONTROL WARNING LIGHTS TYPE C Item 643.0715 Unit Price per DAY in Writing	773	DAYS			
30	TRAFFIC CONTROL ARROW BOARDS Item 643.0800 Unit Price per DAY in Writing	81	DAYS			
31	TRAFFIC CONTROL SIGNS Item 643.0900 Unit Price per DAY in Writing	586	DAYS			
32	TRAFFIC CONTROL SIGNS PORTABLE CHANGEABLE MESSAGE Item 643.1050.S Unit Price per DAY in Writing	60	DAYS			
33	PAVEMENT MARKING EPOXY 4-INCH Item 646.0106 Unit Price per Linear Foot in Writing	4,249	LF			
34	FLOWABLE FILL Item SPV.0035.01 Unit Price per Cubic Yard in Writing	9	CY			
	ALT 1 BID GRAND TOTAL IN FIGURES					
	ALT 1 BID GRAND TOTAL IN WRITING					

Bidders are requested to quote unit prices and make extensions for each item on the following Bid Schedule, in accordance with the proposal conditions, specifications, drawings, exhibits, and standard forms listed herein and made a part hereof. Unit prices so quoted herein shall govern in all cases.

BIDDER'S ATTENTION IS SPECIFICALLY DIRECTED to the fact that the items listed herein constitute one complete bid schedule comprising a single job unit, and the price on all items listed must be quoted in order to qualify as an acceptable bid.

BID SCHEDULE - ALT-2
GMIA - Tugway and Runway Bridge Improvements Over Howell Avenue
Tugway Bridge
Project No. WA5051-11603

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
1	MOBILIZATION Item M-1 Unit Price per Lump Sum in Writing	1	LS			
2	FINISHING ROADWAY Item 213.0100 Unit Price per Each in Writing	1	EACH			
3	CONCRETE SURFACE REPAIR Item 509.1500 (See DOT Specification) Unit Price per Square Foot in Writing	115	S.F.			
4	MOBILIZATIONS EMERGENCY EROSION CONTROL Item 628.1910 Unit Price per Each in Writing	1	EA			
5	EPOXY CRACK SEALING Item SPV.0090.01 (See Project Specification) Unit Price per Linear Foot in Writing	850	L.F.			
6	VENT TUNNEL EXPANSION JOINT REPAIR Item SPV.0090.02 Unit Price per Linear Foot in Writing	222	L.F.			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
7	TRAFFIC CONTROL DRUMS Item 643.0300 Unit Price per DAY in Writing	1,511	DAYS			
8	TRAFFIC CONTROL BARRICADES TYPE III Item 643.0420 Unit Price per DAY in Writing	31	DAYS			
9	TRAFFIC CONTROL WARNING LIGHTS TYPE C Item 643.0715 Unit Price per DAY in Writing	577	DAYS			
10	TRAFFIC CONTROL WARNING LIGHTS TYPE A Item 643.0705 Unit Price per DAY in Writing	62	DAYS			
11	TRAFFIC CONTROL SIGNS Item 643.0900 Unit Price per DAY in Writing	309	DAYS			
12	TRAFFIC CONTROL ARROW BOARDS Item 643.0800 Unit Price per DAY in Writing	60	DAYS			
13	CONCRETE STAINING Item SPV.0165.01 Unit Price per Square Foot in Writing	2,535	S.F.			
14	TRAFFIC CONTROL SIGNS PORTABLE CHANGEABLE MESSAGE Item 643.1050.S Unit Price per DAY in Writing	15	DAYS			
15	PAVEMENT MARKING EPOXY 4-INCH Item 646.0106 Unit Price per Linear Foot in Writing	960	LF			
16	TRAFFIC CONTROL Item 643.0100 Unit Price per Each in Writing	1	EACH			
17	TC SURVEILLANCE AND MAINTENANCE Item 643.0200	1	EACH			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
	Unit Price per Each in Writing					
	ALT 2 BID GRAND TOTAL IN FIGURES					
	ALT 2 BID GRAND TOTAL IN WRITING					

Bidders are requested to quote unit prices and make extensions for each item on the following Bid Schedule, in accordance with the proposal conditions, specifications, drawings, exhibits, and standard forms listed herein and made a part hereof. Unit prices so quoted herein shall govern in all cases.

BIDDER'S ATTENTION IS SPECIFICALLY DIRECTED to the fact that the items listed herein constitute one complete bid schedule comprising a single job unit, and the price on all items listed must be quoted in order to qualify as an acceptable bid.

BID SCHEDULE - ALT 3
GMIA - Perimeter Road Bridge Over Howell Avenue
Perimeter Road
Project No. WA163-11602

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
1	MOBILIZATION Item M-1 Unit Price per Lump Sum in Writing	1	LS			
2	COMMON EXCAVATION Item 205.0100 Unit Price per Cubic Yard in Writing	1,600	CY			
3	FINISHING ROADWAY Item 213.0100 Unit Price per Each in Writing	1	EACH			
4	BASE AGGREGATE DENSE 3/4 INCH Item 305.0110 Unit Price per TON in Writing	416	TON			
5	BASE AGGREGATE DENSE 1 1/4 INCH Item 305.0120 Unit Price per TON in Writing	4,427	TON			
6	CONCRETE PAVEMENT 9-INCH Item 415.0090 Unit Price per Square Yard in Writing	6,927	SY			
7	DRILLED DOWEL BARS Item 416.0620 Unit Price per Each in Writing	48	EA			
8	ASPHALTIC MATERIAL PG58-28 Item 455.0105 Unit Price per Ton in Writing	49	TON			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
9	PROTECTIVE SURFACE TREATMENT Item 502.3200 Unit Price per Square Yard in Writing	1,293	SY			
10	CONCRETE MASONRY RETAINING WALLS Item 504.0500 Unit Price per Cubic Yard in Writing	940	CY			
11	BAR STEEL REINFORCEMENT HS COATED RETAINING WALL Item 505.0615 Unit Price per Pound in Writing	146,730	LB			
12	RUBBERIZED MEMBRANE WATERPROOFING Item 516.0500 Unit Price per Square Yard in Writing	72	SY			
13	CONCRETE STAINING STRUCTURE Item 517.1010.S Unit Price per Square Foot in Writing	38,000	SF			
14	APRON END WALLS FOR CULVERT PIPE 12-INCH DIA Item 520.1012 Unit Price per Each in Writing	3	EACH			
15	APRON END WALLS FOR CULVERT PIPE 24-INCH DIA Item 520.1024 Unit Price per Each in Writing	2	EACH			
16	CULVERT PIPE REINFORCED CONCRETE CLASS IV Item 522.0348 Unit Price per Linear Foot in Writing	54	LF			
17	RIP-RAP MEDIUM Item 606.0200 Unit Price per Cubic Yard in Writing	22	CY			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
18	STORM SEWER PIPE REINFORCED CONCRETE CLASS III 12-INCH Item 608.0312 Unit Price per Linear Foot in Writing	1,433	LF			
19	STORM SEWER PIPE REINFORCED CONCRETE CLASS III 24-INCH Item 608.0324 Unit Price per Linear Foot in Writing	74	LF			
20	CATCH BASIN TYPE 2 Item 611.0103 Unit Price per Each in Writing	12	EACH			
21	MANHOLES TYPE 2 Item 611.0205 Unit Price per Each in Writing	7	EACH			
22	MANHOLE COVERS TYPE J-SPECIAL Item 611.0535 Unit Price per Each in Writing	7	EACH			
23	INLET COVERS TYPE V Item 611.0654 Unit Price per Each in Writing	12	EACH			
24	PIPE UNDERDRAIN WRAPPED 6-INCH Item 612.0406 Unit Price per Linear Foot in Writing	2,000	LF			
25	ANCHOR ASSEMBLIES FOR STEEL PLATE BEAM GUARD Item 614.0150 Unit Price per Each in Writing	4	EACH			
26	STEEL THRIE BEAM STRUCTURE APPROACH Item 614.0250 Unit Price per Linear Foot in Writing	13	LF			
27	STEEL PLATE BEAM GUARD CLASS A Item 614.0305 Unit Price per Linear Foot in Writing	14	LF			
28	SALVAGED TOPSOIL	22,500	SY			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
	Item 625.0500 Unit Price per Square Yard in Writing					
29	MULCHING Item 627.0200 Unit Price per Square Yard in Writing	2,490	SY			
30	FERTILIZER TYPE B Item 629.0210 Unit Price per CWT in Writing	1.78	CWT			
31	SEEDING MIXTURE NO. 30 Item 630.0130 Unit Price per LB in Writing	406	LB			
32	SEEDING MIXTURE NO. 80 Item 630.0180 Unit Price per LB in Writing	2	LB			
33	SOD LAWN Item 631.1000 Unit Price per Square Yard in Writing	2,480	SY			
34	POSTS WOOD 4x6-INCH X 14-FT Item 634.0614 Unit Price per Each in Writing	18	EACH			
35	SIGNS REFLECTIVE TYPE II Item 637.0202 Unit Price per Square Feet in Writing	91	SF			
36	MOVING SIGNS TYPE II Item 638.2102 Unit Price per Each in Writing	11	EACH			
37	REMOVING SMALL SIGN SUPPORTS Item 638.3000 Unit Price per Each in Writing	11	EACH			
38	TRAFFIC CONTROL Item 643.0100 Unit Price per Each in Writing	1	EACH			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
39	GEOTEXTILE FABRIC TYPE HR Item 645.0120 Unit Price per Square Yard in Writing	45	SY			
40	PAVEMENT MARKING ARROWS EPOXY TYPE 2 Item 647.0166 Unit Price per Each in Writing	1	EACH			
41	PAVEMENT MARKING WORDS EPOXY Item 647.0356 Unit Price per Each in Writing	1	EACH			
42	PAVEMENT MARKING STOP LINE EPOXY 18-INCH Item 647.0566 Unit Price per Linear Foot in Writing	36	LF			
43	PAVEMENT MARKINGS ISLAND NOSE EPOXY Item 647.0606 Unit Price per Each in Writing	1	EACH			
44	CONSTRUCTION STAKING STORM SEWER SYSTEM Item 650.4000 Unit Price per Each in Writing	2	EACH			
45	CONSTRUCTION STAKING SUBGRADE Item 650.4500 Unit Price per Linear Foot in Writing	1,739	LF			
46	CONSTRUCTION STAKING BASE Item 650.5000 Unit Price per Linear Foot in Writing	1,739	LF			
47	CONSTRUCTION STAKING CURB GUTTER CURB & GUTTER Item 650.5500 Unit Price per Linear Foot in Writing	71	LF			
48	CONSTRUCTION STAKING CONCRETE PAVEMENT Item 650.7000 Unit Price per Linear Foot in Writing	1,739	LF			

Item No.	Item	Estimated Quantity	Unit	Unit Price	Amount Dollars	Amount Cents
49	CONSTRUCTION STAKING SUPPLEMENTAL CONTROL Item 650.9910 Unit Price per Lump Sum in Writing	1	LS			
50	CONSTRUCTION STAKING SLOPE STAKES Item 650.9920 Unit Price per Linear Foot in Writing	1,739	LF			
51	GRASS SWALE Item SPV.0035 Unit Price per Cubic Yard in Writing	180	CY			
52	PRESTRESSED PRECAST CONCRETE WALL PANEL Item SPV.0165.02 Unit Price per Square Foot in Writing	33,890	SF			
	ALT 3 BID GRAND TOTAL IN FIGURES					
	ALT 3 BID GRAND TOTAL IN WRITING					

SPECIAL PROVISIONS

GMIA Perimeter Road Bridge Over Howell Avenue

1. Scope of Work

Perform the work under this construction contract for Project A163-11602 General Mitchell International Airport GMIA Perimeter Road Bridge over Howell Avenue Project in Milwaukee County, Wisconsin as the plans show and execute the work as specified.

The work under this contract will consist of constructing a 240 foot long, two-span pre-stressed concrete girder bridge over Howell Avenue with perimeter roadway segments on either side. Roadway approaches to the bridge will be retained within mechanically stabilized earth (MSE) retaining walls; approximately 1,100 feet of MSE retaining walls for the east approach to the bridge, approximately 750 feet of MSE retaining wall for the west approach to the bridge. This project is located is close proximity to Runway 7R-25L, a primary runway at General Mitchell International Airport. Runway 7R-25L must be kept operational to the maximum extent practicable and the project includes considerations for security, height of construction, coordination of daily closures of the runway and other affected airport facilities.

The perimeter road segments leading to the bridge structure will connect to an existing airfield service road west of Howell Avenue, and will connect into Citation Way east of Howell Avenue. The project includes reconstruction and realignment of a portion of Citation Way to accommodate the perimeter road alignment, as well as reconstruction of a portion of Howell Avenue to accommodate the new intersection with Citation Way. The project includes construction staging and traffic control to maintain traffic on Howell Avenue and Citation Way during construction of the perimeter road and structures. The perimeter road has a clear width of 42 feet over the bridge and within the retaining walls. The total length of the project is approximately 2,000 feet as measured along the perimeter road.

A number of both public and private utility relocations are included within the project's limits and will need to be coordinated with the overall phasing of construction. Additionally, the Federal Aviation Administration (FAA) has a number of underground lines and facilities that will likewise need to be relocated or otherwise protected during construction. The project includes construction of new security fencing and a controlled security gate, storm sewer, and excavation within the existing Mitchell Field Drainage Ditch. The work under this contract also includes repairs to the existing Howell Avenue tunnel structure under Runway 7R-25L on Howell Avenue. This work is the completion of work that was not completed under a previous contract.

This project will be a working day contract, separated into a base bid and three alternates, with a number of working days assigned to each. Alternates will be awarded according to funding availability (see Section 3, Project Phasing and Alternatives section for more detail). The total number of working days will be commensurate with the number of alternates that funding allows, and will vary depending on the alternates awarded. If funding and phasing allows, Alternate 1, 2 and 3 work can be constructed concurrently with the Base Bid work.

<u>Base Bid – (110 Working Days):</u>

The work under the Base Bid generally consists of the following:

- Demolition and reconstruction of Citation Way to the north
- Reconfiguration of the Howell Ave. median and east shoulder to accommodate the proposed structure central pier and the new location of Citation Way
- Construction of foundation and central pier of the proposed overcrossing structure
- Construction of the east abutment for the proposed overcrossing structure
- Construction of the east Mechanically Stabilized Earth Wall and fill
- Construction of the east half of the GMIA Perimeter Road
- Modification of the existing east security fence and the addition of a new gate at the intersection of the Perimeter Rd. and Citation Way

Alternate No. 1 – (60 Working Days):

The work under Alternate 1 generally consists of the following:

- Construction of the west abutment for the proposed Overcrossing structure
- Construction of the west Mechanically Stabilized Earth Wall and fill
- Construction of the west half of the GMIA Perimeter Road
- Construction of the two gravel access roads to the existing airport shelter facilities
- Modification of the existing west security fence

Alternates No. 2 – (21 Working Days):

The work under Alternate 2 generally consists of the following:

- This alternate includes the superstructure for the proposed overcrossing structure and completes the Perimeter Road.

Alternates No. 3 – (60 Working Days):

The work under this Alternate generally consists of the following:

- This alternate includes repairs to the existing Runway 7R-25L tunnel structure located on Howell Avenue.

See Section 7 (Liquidated Damages) for penalties associated with working day overruns for each segment of work.

2. Specifications

The work under this contract shall be in accordance with the Plans, the General Provisions, the Specifications, the applicable FAA Advisory Circulars covering the construction of airports, the 2012 Edition of the Wisconsin Department of Transportation (WisDOT) Standard Specifications for Highway and Structure Construction, and any updates, and these Special Provisions.

A. Pay Items having numbers beginning with “M”, "P", "F", "D", "T", "L", “JS”, and "X" shall be executed under the requirements of the General Provisions, the Specifications, and the applicable FAA Advisory Circulars covering the construction of airports, and these Special Provisions.

B. Pay Items having numbers beginning with “W” and with “W” followed by “S” or “SPV” shall be executed under the General Provisions, the requirements of the State of Wisconsin, Department of Transportation, **Standard Specifications for Highway and Structure Construction, 2012 Edition;** the enclosed Standard Specifications and these Special Provisions.

3. Award of Contract (Project Phasing Alternatives)

Due to uncertain timing and amounts of funding, this project has been organized into a Base Bid and three Alternates. Pending funding availability, it is the intent to award the Base Bid by October 1, 2012 and the remainder of the project in March 2013. The initial contract will be based on the funding that is available in 2012 and it will consist of work to be done under the Base Bid, plus any alternates that available 2012 funding allows.

The award of a Contract, if it is awarded, will be made to the lowest, responsive and responsible Bidder based on the sum of the Base Bid and all Alternates. A Contract for Base Bid and all Alternates will be provided to the successful bidder for construction to commence in March 2013.

Funding conditions may necessitate adding the alternates by Contract Change Order (CCO) or multiple CCOs at a later date, for project construction later in calendar year 2013. Funding conditions may delay issuing the CCO(s) until July 1, 2013. The portion of the Proposal Guaranty to cover remaining alternate work shall remain in effect until execution of any CCO(s). Adjustment or revisions to the original unit bid prices will not be made. The Contractor shall not claim any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from issuing any CCO(s) or indirectly from Contractor's unbalanced allocation of overhead and profit between the Base Bid and any alternates, or from any other cause.

Upon issuance of any CCO(s), the Contractor shall furnish any additional Contract Bonds, proof of insurance, DBE forms, sublet requests, and other documents required to be filed by the Contractor.

Should the Owner fail to issue any CCO(s) by July 1, 2013, the Contractor may nullify their original unit bid prices for all work not awarded by filing due notice of intent with the Owner. The notice shall be in writing and may be filed at any time after July 1, 2013. The notice shall stipulate the maximum number of days, not less than 10, exclusive of Sundays and holidays, within which any CCO can be issued by the Owner. Failure of the Owner to issue any CCO(s) within the time set forth in the notice, will be construed to be an Owner acceptance of the nullification of the bids for the remaining work not awarded. The Owner reserves the right to cancel any remaining work without liability to the Owner. At such time, the Contractor and the Contractor's Surety will be relieved of all obligations to the Owner that may have been incurred under the Contract and Contract Bonds.

4. Schedule of Work

The work under this contract shall commence within ten (10) days after the required project start date identified on the written Notice to Proceed issued by the County. The Notice to Proceed will be issued after execution of the contract and is expected to be issued by approximately October 1, 2012. However, the actual construction start for many aspects of the project is subject to completion of other construction projects as detailed within *Section 5, Notice of Other Contracts* and **can start no sooner than March of 2013**. All work on the project shall be completed within the number of working days assigned to the work awarded, commencing from the start date identified on the Notice to Proceed. See Project Execution section for additional project time constraints and schedule information.

This contract contains requirements for construction project scheduling to be performed by the Contractor. The scheduling shall conform to the specific requirements contained in the Construction Schedule section preceding these Special Provisions. All costs associated with construction scheduling, coordination with the airlines, airport security and airport operations by the Contractor, shall be considered incidental to Mobilization bid items.

It is the responsibility of the Contractor to revise and submit his schedule whenever there is a significant change in progress or deviation from the schedule. The revised schedule shall identify in sufficient detail how the Contractor intends to return to the original completion schedule. In the event the contractor determines he/she cannot meet the project deadline, he/she must submit written request for a time extension to the engineer immediately. Failure to submit written request for a time extension does not relieve the contractor from incurring liquidated damages as outlined in the project specification.

5. Notice of Other Contracts

The Milwaukee County Highway Department, and General Mitchell International Airport (GMIA) will have other contractors working in the vicinity of the project site. The contractor shall coordinate proposed work with other contractors working near the project site to avoid disruptions and delays of work being completed by other contractors. The list of known projects to be completed by others and their impact to the GMIA Howell Avenue Perimeter Road Bridge project include, but may not be limited to:

1. Runway Safety Area (RSA) Improvement Projects, GMIA Project A094-05001 Nos. 1 - 5:
The final phase of the Runway Safety Area Improvement project is currently underway at General Mitchell International Airport. This project, and the overall RSA projects, are scheduled for completion within the 2012 construction year, but may require punch list, follow-up, and closeout work items to be completed that could require the occasional closure of Runway 1L-19R. At no time can both Runway 7R-25L and Runway 1L-19R be closed concurrently.

2. Reconstruction of Runway 1L-19R pavements at the Intersection with Runway 7R-25L:
General Mitchell International Airport is currently underway reconstructing portions of Runway 1L-19R on either side of the intersection with Runway 7R-25L. This project is scheduled for completion within the 2012 construction year, but may require punch list, follow-up, and closeout work items to be completed that could require the occasional closure of both Runway 1L-19R and Runway 7R-25L. Because this project has impacts to both primary runways, the closures for this project are restricted to weekend hours from 12:00 a.m. to 5:00 a.m.

3. Runway 1L-19R Panel Replacement Project:
General Mitchell International Airport is currently underway reconstructing panels at various locations down the length of Runway 1L-19R. This project is scheduled for completion within the 2012 construction year, but may require punch list, follow-up, and closeout work items to be completed that could require the occasional closure of Runway 1L-19R. At no time can both Runway 7R-25L and Runway 1L-19R be closed concurrently.

4. South Maintenance Area Re-Development Projects:
General Mitchell International Airport is currently undergoing planning and design efforts for the re-development of its South Maintenance Area. This is the area located immediately east of the proposed project limits, primarily south of Citation Way. For the 2013 construction season, one or more building improvement projects may be occurring within the South Maintenance Area, which is most commonly accessed via Howell Avenue and Citation Way. The Airport has identified that alternate access points to the South Maintenance Area can be provided through the old 440th Guard property, however, and it not anticipated that these construction improvements will have an impact to the Howell Avenue Perimeter Road Bridge project.

5. Runway 7R-25L Pavement Repairs and Maintenance:
General Mitchell International Airport is currently planning pavement repairs and other maintenance work on Runway 7R-25L during the 2013 construction season. It is not anticipated that this work will have any impact to the proposed Howell Avenue Perimeter Road Bridge project, and it is the intent that the closures for Runway 7R-25L will be utilized to accommodate both projects at the same time.

6. Westbound Airport Spur Reconstruction:
The Wisconsin Department of Transportation is currently reconstructing the westbound portion of the Airport Spur. As part of the project, Howell Avenue is currently being used as a detour route to direct traffic to Interstate I-94. This project is scheduled for completion in the 2012 construction season. While being utilized as a detour route, Howell Avenue will continue to experience high volumes of traffic and it is not anticipated that the Wisconsin DOT will allow preliminary utility relocations to occur that would impact the access and utility of this roadway segment.

6. Project Execution

General Mitchell International Airport will remain in full operation during the construction project with the exception of scheduled daily closures as identified in the plans and these special provisions. Contractor is responsible for airfield coordination with airlines, airport operations, and airport engineering. No additional compensation will be made for failure of contractor to account for any additional costs in regard to coordination with the airlines, airport operations, and airport engineering.

Additionally, it is the responsibility of the contractor to coordinate the construction of the project with the relocation of both the public and private utilities that are impacted, and their respective contacts (See Section 24). No additional compensation will be made for failure of the contractor to account for additional cost in regards to the coordination and timing of utilities to be relocated, either by the contractor or other forces as described in Section 24.

Any bridge work involving the use of a crane or other construction which penetrates the protected airspace of Runway 7R-25L will require daily closures of the runway and shall be coordinated with GMIA Airport Operations. See Sheet G-082 of the plans which illustrates the Part 77 airspace contour elevations associated with Runway 7R-25L as they relate to the project's work limits. Required Runway closures shall be discussed and scheduled no less than 2 days prior to the anticipated closure. Approved closures are still subject to last minute revocation due to weather or other issues as more fully detailed in the Work Area Availability section below. **Runway closures will be limited between the hours of 9:00 AM and 6:00 PM.** Runways will need to be closed when working within the airspace, the runway safety area, or within locations that impact the navigational instruments of Runway 7R-25L.

Several annual events are scheduled in and around the airport which also may have an impact on the availability of runway closures. These events include the Milwaukee Air and Water Show, the EAA AirVenture, and various Armed Forces events. Additional events not otherwise identified may also be programmed. The exact dates of these events are not currently known or yet established, but generally occur in the summer months and may be subject to schedule changes.

A. Work Area Availability

Contractor understands that General Mitchell International Airport is a working international airport, and that from time to time runways, taxiways and other facilities at General Mitchell International Airport may not be closed or unavailable due to any number of reasons including, but not limited to, weather, technical matters, safety and security considerations or agency determinations. Contractor also understands that winter weather conditions in particular at General Mitchell International Airport increase the likelihood that runway closures may not be available for construction. Contractor further understands and acknowledges that Owner shall not be liable to Contractor and/or Subcontractor for any claims or damages or monetary claims of any kind caused by, related to, or arising out of any delays of any kind. Contractor's sole remedy against Owner for any delays of any kind on this project shall be an allowance to claimant of additional time for completion of work, the amount thereof to be determined by Engineer in accordance with the foregoing provisions of the above subparagraphs.

B. Work Site Access and Safety

All movements shall be coordinated through the engineer and/or airport operations. At the end of the work-day the work area must be cleaned to the satisfaction of airport operations.

This project's work is located immediately adjacent to an active runway. See the article Operational Safety below for specific conditions and restrictions for project work within in these areas.

C. Holiday Work Restrictions

Unless the Contractor has made special arrangements with the Owner, the following Federal legal Holidays shall be observed by Contractor;

New Years Day	1st January
Martin Luther King's Birthday	Third Monday of January
President's Day	Third Monday of February
Memorial Day	Last Monday of May

Independence Day	4th of July
Labor Day	First Monday in September
Columbus Day	Second Monday in October
Veteran's Day	11th of November
Thanksgiving Day	Fourth Thursday in November
Christmas Day	25th of December

Any of the holidays falling on a Saturday will be observed the preceding Friday, holidays falling on a Sunday will be observed on the following Monday.

7. Liquidated Damages

Liquidated damages of One Thousand Dollars ($1,000.00) will be assessed for each working day the Contractor performs work on the project beyond the number of working days assigned to the work awarded in the CONTRACT until the project is fully complete. This amount is based on engineering inspection and Airport Operations costs.

During all phases, Authorization will be given, if requested, for overtime work, at no additional cost to the County, but authorization will be withheld if the Contractor has chosen not to work during hours allowable under the contract. A timely request must be given and authorization following short notice requests will be subject to the availability of engineering and operations personnel required to allow the work.

8. Construction Superintendant

The following supplements Section 50 of the General Provisions:

A. The Contractor shall furnish a construction superintendent for the duration of the project to provide construction management.

B. The responsibilities of the construction superintendent include, but are not limited to: coordination with the Engineer, the airport, FAA, and all subcontractors; scheduling of subcontractors; supervision of all construction; supervision of all signing, barricades and lighting; quality control, change order approval; scheduling and monitoring gate guards and haul routes; coordination with all utilities involved and attendance at all construction meetings.

C. The construction superintendent shall be employed by the prime contractor and shall be named at the preconstruction conference, subject to the approval of the Engineer. The superintendent cannot switch responsibility to a subcontractor or other individual unless approved by the Engineer. The superintendent will be available 24 hours a day and will be on the construction site when there is any construction activity on the airport, unless otherwise approved by the engineer. During times of day and night work schedules, the superintendent may appoint an additional superintendent, as approved by the Engineer. At all times during construction, one of these approved superintendents must be on the airport, unless otherwise approved by the Engineer.

D. Weekly construction meetings will be required unless otherwise authorized by the Engineer. Daily meetings may be scheduled if desired by the Engineer, during critical periods.

E. This item also includes separate construction trailers, electric services and phone services to be used for the construction superintendent if he deems one necessary.

F. Liquidated damages for not having this construction superintendent on the project site at all times while there is construction activity will be made on a per day basis. The liquidated damages will be five hundred ($500) dollars per working day to be administered by the Engineer.

9. Contractor's Staging Area

The Contractor will be assigned project staging areas for material and equipment, which are approximately located on the Construction Operations Plan, Sheet G-081. Within the secured area of the airport, the contractor shall establish the construction site for staging as necessary but shall maintain all material and equipment outside of the existing runway or taxiway safety areas (RSA, TSA), outside the glideslope and localizer critical areas, and below the restricted airspace for approach and departure operations to/from Runways 7R-25L.

Materials and equipment remaining on the airport following a day's work activity shall be moved to these staging locations. The Contractor shall not park or store equipment and materials on the existing roads and parking areas, and shall keep drives and streets clean. The Contractor and his employees will not be allowed in existing buildings unless allowed by the owner.

The assigned staging area shall only be used for the short-term temporary storage of materials and equipment to be used for this project only. This area shall not be used (and no other area will be provided) for concrete batching, concrete crushing or other similar operations unless allowed by the owner.

10. Security

This project includes the placement of temporary security fencing and gates that will allow most of the project's work to be maintained outside the secure area of the airport.

For any work occurring inside the secured area of the Airport, Federal regulations require that any person, including contractors and their employees and delivery truck drivers who enter this area, wear on their outer garment a color coded airport identification badge, and that all vehicles requiring access to this area display a color coded placard in the windshield. See the Security and Safety Specifications in these contract documents for further details and availability of these badges and placards. Payment for costs associated with obtaining airport identification badges shall be included in the unit prices for the mobilization pay items of the project. See the Mobilization Specification in these contract documents for additional information.

It shall be the Contractor's responsibility to see that these regulations are strictly enforced, and any fines or penalties imposed for violations of these rules will be assessed against the Contractor.

Some isolated segments of the project will require the contractor to work inside the secured areas of the airport. Proper badging will be required for all contractor personnel working in these locations. **No supervision or security oversight of contractor personnel by airport staff should be expected.** This will also include all project related deliveries to the site.

11. Employee Parking

Parking of contractor employees shall be in designated locations. Milwaukee County will allot parking spaces to the contractors and they shall use only those spaces for parking employee vehicles. Parking space allotments and additional parking requirements will be determined at the Project Pre-construction Meeting. Private vehicles will not be allowed in the project area or other secured areas of the airport.

12. Operational Safety

General Mitchell International Airport will remain in full operation during this construction project with the exception of scheduled daily runway closures as appropriate and identified for the work phases of this project.

Federal Aviation Regulations require that no construction activity be permitted within specific distances to runways or taxiways while aircraft operations are being conducted on these pavements. For this project construction activities will not be permitted outside of each of the phase area limits as shown on the phasing plan and defined herein without prior arranged and approved closure of the affected runways or taxiways. Construction activities will not be permitted within 200 feet of an active runway centerline nor within 65 feet of an active taxiway centerline. See FAA Advisory Circular 150/5370-2E for further information on construction operation safety requirements.

The Airport Operations Manager must approve the exact days and times of temporary closures requested by the contractor for access to the area. Some days and times may not be approved, (and approved closures are subject to last minute revocation), due to weather or operational changes. All restricted areas must further be cleared of all excess construction material and equipment.

Project Safety Training: All contractor and subcontractor personnel shall be required to attend a half-day (4 hours) runway incursion safety training seminar before entering the secured airfield. Attendance at the safety training seminar will also be required to obtain an airport identification badge. The contractor shall notify the engineer as soon as possible after award of a contract the exact number of attendees. Training will be held prior to the start of construction at a location designated by the engineer. Classes for the project safety training are not scheduled continuously, and the contractor should plan the training well in advance of the start of work to avoid inadvertent delays. No contractor or subcontractor personnel will be allowed on the secured airfield without previous attendance at the safety training seminar for this project, or as approved by airport operations. Payment for contractor's costs associated with attending project safety training seminar shall be included in the Mobilization bid item(s). If work continues into following year(s), contractor and subcontractor personnel will need to be recertified.

13. No Construction Debris on Airport Paved Surfaces

There will be no dirt, gravel, or other construction debris allowed on the taxiways, runways, or haul routes. Any spillage from trucks or other sources shall be immediately removed. The Contractor shall have sweeping equipment available at all times.

The Contractor shall utilize equipment having vacuum or water spray mechanisms to eliminate the dispersion of particulate matter into the atmosphere. If vacuum equipment is employed, it must have suitable, self-contained particulate collectors to prevent discharge from the collection bin into the atmosphere.

If, in the opinion of the Engineer, the Contractor is remiss in his responsibility for keeping the paved areas clean, the Engineer will have them cleaned by County forces and will back-charge the cost against payment otherwise due to the Contractor at the rate of $150.00 per hour, with a minimum charge per occurrence of $500.00.

14. Barricades, Lighting and Construction Safety Fence

This article addresses the installation, maintenance and removal of temporary barricades, lights, portable lighted runway closure crosses, and restricted area delineation, where designated on the plans, required in these specifications, and/or where required by the Engineer to prevent accidental entry by aircraft or other vehicles into the construction area or to prevent accidental intrusion of construction vehicles and/or personnel into the aircraft operations area or areas of open excavation.

Barricades shall conform to AC 150/5370-2E and will be required where designated on the Construction Operations and Phasing Plan, and at any other locations where, in the opinion of the Engineer, construction conditions are present that are a hazard to the operation of the Airport.

Low-Profile Barricades: Sufficient barricades will be required to discourage vehicular or aircraft entrance to an area. If a continuous line of barricades is specified on the Construction Operations and Phasing Plan, they shall be low-profile type barricades, appropriate for airfield use. There shall be no gaps between individual barricades that are placed on the full-strength taxiway pavement.

A-Frame Barricades: A non-continuous barricade line shall be used with A-Frame barricades to guard open excavations or trenches that are within the work site, or where directed. There shall be no gaps greater than 20 feet between individual barricades. Caution tape, or other approved material shall be used to connect the barricades along the line of open excavation and shall be considered incidental to the work items associated with the open excavations.

Lights: Each individual barricade, regardless of type, shall be equipped with a flashing red warning light, which will be in operation during dark hours. The light unit shall be attached to the barricade with appropriate hardware to adequately secure the light unit so that it will not become separated from the barricade as a result of wind, weather or jet blast from aircraft. The contractor shall be responsible maintaining all barricade lights to the satisfaction of Owner, and Engineer. Such maintenance shall include, but not be limited to cleaning, battery replacement, lamp replacement or complete light unit replacement as deemed necessary. Maintenance and battery replacement shall be performed at a minimum of every 4 weeks, or as directed by Owner or Engineer, and shall be considered incidental.

Construction Safety Fence:
The contractor shall furnish, install, maintain and remove construction safety fence at the locations specified on the Construction Operations and Phasing Plan, and at locations directed by the Owner or Engineer. Construction safety fence shall consist of plastic temporary “snow fence,” that is construction orange in color. It shall be securely fastened to steel posts driven into the ground, so that the fence will remain in place, and not become dislodged and a hazard to aircraft safety. It shall be the contractor’s responsibility to have all underground utilities marked prior to installation of the construction safety fence. The contractor shall be responsible for maintaining the construction safety fence to the satisfaction of the Owner and Engineer.

General:
The Contractor will be required to have personnel on call 24 hours per day for emergency maintenance of all closure crosses, barricades, construction safety fencing and lighting. At the end of construction, or when directed, the contractor shall remove all barricades and/or construction safety fence, and clean and restore all effected areas to the satisfaction of the Owner and Engineer.

Basis of Payment: All costs associated with furnishing, mobilizing, installing, maintaining and removing all barricades, lights, runway closure crosses and construction safety fence, and other associated work shall be borne by the Contractor and shall be considered incidental to traffic control bid items as found in the referenced Standard Specifications of these documents.

15. Construction Area Access

During all phases of the work, access to and from the project site shall be via the Construction Traffic Haul Routes designated on the Construction Operations Plan, Sheet G-081.

For the work on the west side of Howell Avenue, a temporary construction access road is included in the project as illustrated on Sheet C-052 of the plans. This temporary roadway, its associated storm sewer facilities, and the planned temporary security fencing shall be installed in place and approved by Airport Operations prior to hauling or other construction work on the west side of the project area.

With the exception of the pay items associated with the temporary construction access road, all costs associated with providing and maintaining site access shall be considered incidental to construction and the cost shall be included in the appropriate contract prices bid.

This shall include the cost of any restoration of the staging area or haul roads necessary to return them to their pre-construction condition.

16. Employee Access Outside of Construction Limits

Movement of any Contractor employee beyond the construction limits on the Airport Operations Area (AOA) is strictly prohibited without an escort. Construction limits shall be defined at the construction site by the appropriate and proper placement of barricades and construction safety fence.

17. Material Approval

Specifications for certain construction items require the contractor to submit material test reports to the engineer for approval prior to installation. The Engineer may, at his option, accept a material certification in lieu of testing data. Certificates must include specific identification of the product, a concise statement that the product does meet all specification requirements, manufacturer's catalog number or other identification, and the notarized signature of a person authorized by the manufacturer or laboratory to make the certification.

Materials and equipment shall be ordered promptly after award. Contractors shall monitor orders and expedite deliveries to insure receipt in accordance with the completion schedule.

18. Standards and Codes

All work shall be performed in strict conformity with all applicable laws, ordinances and codes, including, but not limited to, FAA requirements, NFPA, Wisconsin Department of Commerce, State Electrical Code, OSHA, WisDOT Standard Specifications for Highway and Structure Construction 2012 Edition, City of Milwaukee Sewer Codes, and the National Board of Fire Underwriters.

The Contractor shall obtain all permits and certificates of compliance required, paying all necessary fees.

19. Environmental Considerations During Construction

The contract section entitled AIRPORT CONSTRUCTION CONTROLS TO PREVENT AIR AND WATER POLLUTION contains requirements for the completion and submission of an Erosion Control Implementation Plan (ECIP). The contractor shall prepare and submit the ECIP to the Milwaukee County project manager in lieu of the WDOT Bureau of Aeronautics project manager as is stated. The ECIP shall be submitted no later than 10 days prior to the start of construction operations.

The Contractor shall be responsible for furnishing, installing, maintaining and removing all erosion control materials throughout the time of construction, and until such time that the permanent restoration of disturbed areas is established to the satisfaction of the Owner and Engineer. All costs associated with this work shall be considered incidental to construction and included in the appropriate contract bid prices.

A Phase I Hazardous Materials Assessment (HMA) was conducted for this project. One site, the Milwaukee County Highway Department, 5800 S. Howell Avenue, was investigated. It is unlikely that there will be any environmental concern to the subject area from this site. However, if contaminated soil is encountered during construction, the disturbed contaminated soil shall be disposed as per Wisconsin Department of Natural Resources (WDNR) guidelines under the supervision of the Owner and Engineer.

20. Environmental Protection, Aquatic Exotic Species Control

The Exotic invasive organisms such as VHS, zebra mussels, purple loosestrife, and Eurasian water milfoil are becoming more prolific in Wisconsin and pose adverse effects to waters of the state. Wisconsin State Statutes 30.715, “Placement of Boats, Trailers, and Equipment in Navigable Waters”, details the state law

that requires the removal of aquatic plants and zebra mussels each time equipment is put into state waters.

At construction sites that involve navigable water or wetlands, use the follow cleaning procedures to minimize the chance of exotic invasive species infestation. Use these procedures for all equipment that comes in contact with waters of the state and/or infested water or potentially infested water in other states.

Ensure that all equipment that has been in contact with waters of the state, or with infested or potentially infested waters, has been decontaminated for aquatic plant materials and zebra mussels prior to being used in other waters of the state. Before using equipment on this project, thoroughly disinfect all equipment that has come into contact with potentially infested waters. Use the following inspection and removal procedures (guidelines from the Wisconsin Department of Natural Resources) for disinfection:

1. Prior to leaving the contaminated site, wash machinery and ensure that the machinery is free of all soil and other substances that could possibly contain exotic invasive species;
2. Drain all water from boats, trailers, bilges, live wells, coolers, bait buckets, engine compartments, and any other area where water may be trapped;
3. Inspect boat hulls, propellers, trailers and other surfaces. Scrape off any attached mussels, remove any aquatic plant materials (fragments, stems, leaves, seeds, or roots), and dispose of removed mussels and plant materials in a garbage can prior to leaving the area or invested waters; and
4. Disinfect your boat, equipment and gear by either:
   a. Washing with ~212º F water (steam clean), OR
   b. Drying thoroughly for five days after cleaning with soap and water and/or high pressure water, OR
   c. Disinfecting with either 200 ppm (0.5 oz per gallon or 1 Tablespoon per gallon) Chlorine for 10-minute contact time or 1:100 solution (38 grams per gallon) of Virkon Aquatic for 20- to 30-minute contact time. Note: Virkon is not registered to kill zebra mussel veligers nor invertebrates like spiny water flea. Therefore this disinfect should be used in conjunction with a hot water (>104º F) application.

Complete the inspection and removal procedure before equipment is brought to the project site and before the equipment leaves the project site.

21. Emerald Ash Bore Tree Quarantine

This special provision applies to all projects in the emerald ash borer (EAB) quarantined zones, and include Fond du Lac, Kenosha, Milwaukee, Ozaukee, Racine, Sheboygan, Washington and Waukesha counties.

The emerald ash borer (EAB) has resulted in a quarantine of ash trees (Fraxinus, sp) by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) and the Wisconsin Department of Natural Resources (DNR).

Ash trees species attacked by emerald ash borer include the following:

Green ash (F. pennsylvanica) is found throughout the state, but is. most common in southern Wisconsin. It may form pure stands or grow in association with black ash, red maple, swamp white oak, and elm. It grows as an associate in upland hardwood stands, but is most common in and around stream banks, floodplains, and swamps.

Black ash (F. nigra) is distributed over the entire state but is most frequently found in northern Wisconsin. It is most common in swamps, but is also found in other wet forest types.

Blue ash (F. quadrangulata) is a threatened species that is currently found only at a few sites in Waukesha County. The species is at the edge of its range in Wisconsin, but is common in states farther south. The species is not of commercial importance. Blue ash twigs are 4-sided.
White ash (F. americana) tends to occur primarily in upland forests, often with Acersaccharum Includes all horticultural cultivars of these species.

(Note: blue ash twigs are 4-sided. All other Wisconsin ash trees have round stems.)

Mountain ash (Sorbus americana and S. decora) is not a true ash and is not susceptible to EAB infestation.

Follow and obey the following Wisconsin Department of Agriculture, Trade, and Consumer Protection order:

ATOP 21.97 Emerald ash borer; import controls and quarantine.

1. IMPORTING OR MOVING REGULATED ITEMS FROM INFESTED AREAS; PROHIBITION. Except as provided in sub. (3), no person may do any of the following:

   (a) Import a regulated item under sub. (2) into this state if that item originates from an emerald ash borer regulated area identified in 7C.FR 301.53-3.
   (b) Move any regulated item under sub. (2) out of an emerald ash borer regulated area that is identified in 7CFR 301.53-3 and located in this state.

   Note: the United States Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) periodically updates the list of regulated areas in 7CFR 301.53-3. Subsection (1) applies to new regulated areas as those areas are identified in the CFR.

2. REGULATED ITEMS. The following are regulated items for purposes of sub. (1):
   (a) the emerald ash borer, Agrilus planipennis Fairmaire in any living stage.
   (b) Ash trees.
   (c) Ash limbs, branches, and roots.
   (d) Ash logs, slabs or untreated lumber with bark attached. \
   (e) Cut firewood of all non-coniferous species.
   (f) Ash chips and ash bark fragments (both composted and uncomposted) larger than one inch in diameter.
   (g) Any other item or substance that may be designated as a regulated item if a DATCP pest control official determines that it presents a risk of spreading emerald ash borer and notifies the person in possession of the item or substance that it is subject to the restrictions of the regulations.

Regulatory Considerations
The quarantine means that ash wood products may not be transported out of the quarantined area.

If ash trees are identified within clearing and grubbing limits of the project, the following measures are required for the disposal:

Chipped Ash Trees

1. May be left on site if used as landscape mulch within the project limits.
2. May be buried on site within the right-of-way in accordance with Section 201.3 (14) of the WisDOT standard specifications for highways and structure construction (standard specifications).

3. May be buried on adjacent properties to projects within the quarantined zone with prior approval of the engineer in accordance with section 201.3 (15) of the standard specifications.
4. May be trucked to a licensed landfill within the quarantined zone with the engineer's approval in accordance with section 201.3 (15) of the standard specifications.
5. Burning chips is optional if in compliance with section 201.3 of the standard specifications.
6. Chips must be disposed of immediately and may not be stockpiled.
7. Chipper equipment must be cleaned following post-chipping activities to insure no spread of wood chip debris into non-quarantined counties.

Ash Logs, Branches, and Roots

1. May be buried without chipping within the existing ROW or on adjacent properties in accordance with section 201.3 (14)(15) of the standard specifications.
2. May be trucked to a licensed landfill within the quarantined zone with the engineer's approval in accordance with section 201.3 (15) of the standard specifications.
3. Burning is optional if in compliance with section 201.3 of the standard specifications.
4. Ash logs, branches, and roots must be disposed of immediately and may not stockpiled.

All additional costs will be incidental to clearing and grubbing items.

Anyone moving firewood or ash products from the state or these counties is subject to state and federal tines up to $1,000.00. All fines are the responsibility of the contractor. Obtain updated quarantine information at the DNR Firewood Information Line at 1-800-303-WOOD.

Furnishing and Planting Plant Materials

This applies to projects in the emerald ash borer (EAB) quarantined zones to include, Fond du Lac, Kenosha, Milwaukee, Ozaukee, Racine, Sheboygan, Washington, and Waukesha counties.

Supplement 632.2.2 of the standard specifications with the following:

The emerald ash borer (EAB) has resulted in a quarantine of ash trees (Fraxinus, sp) by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) and the Wisconsin Department of Natural Resources (DNR).

Ash trees may be obtained from inside or outside the quarantine area and planted within the quarantined area. Ash trees from within the quarantine area may not be transported and planted into the non-quarantined area.

Updates for compliance

Each year, as a service, the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) distributes an updated federal CFR listing to nursery license holders and other affected persons in this state. More frequent updates, if any, are available on DATCP's website at www.datcn.state.wi.us. The subsection Regulatory Consideration applies to new regulated areas as those areas are identified in the CFR, regardless of whether affected persons receive update notices from the department. Persons may request update notices by calling **(648) 224-4573**, by visiting DATCP's website, or by writing to the following address:

Wisconsin Department of Agriculture, Trade and Consumer Protection
Division of Agricultural Resource Management
P.O. Box 8911
Madison WI 53708-891

Regulated Items

More frequent updates, if any, are available on DATCP's website at www.datcp.state.wi.us. Subsection Regulatory Consideration applies to new regulated areas as those areas are identified in the CFR, regardless of whether affected persons receive update notices from the DATCP. Persons may request update notices by calling (608) 224-4573, by visiting DATCP's website, or by writing to DATCP at the above address.

22. Allowances

Discretion in the use of funds in the allowance items shall rest solely with the Owner. Miscellaneous Allowance is stated on the Bid Schedule, Miscellaneous Allowance. Utility Relocation Allowance is stated on the Bid Schedule, Utility Allowance (see Section 24 for additional information regarding this item).

Work directed to be done under the allowance items shall have costs determined on the basis of Section 90-05 of the General Provisions. Payment for expenditures from the allowance items will be authorized by an Allowance Authorization. At closeout of Contract, funds remaining in the allowance items will be credited to Owner.

23. Traffic.

Supplement 643.3.1 of the standard specifications with the following:

Have available at all times sufficient experienced personnel to promptly install, remove and reinstall the required traffic control devices to route traffic in order to perform the operations.

Provide the Milwaukee County Sheriff's Department, State Patrol, emergency services, fire department, and engineer a telephone number with which the contractor or representative can be contacted during non-working hours in the event a safety hazard develops.

Do not permit equipment or vehicles to directly cross the live traffic lanes of the roadway. Yield to all through traffic at all locations. Equip all contractor's vehicles or equipment operating in the live traffic lanes with a hazard identification beam (flashing yellow signal light). Operate the flashing yellow beam only when merging or exiting live traffic lanes or when parked or operating on shoulders.

Obtain prior approval from the engineer for the locations of egress or ingress for construction vehicles to prosecute the work.

Do not disturb, remove or obliterate any traffic control signs, advisory signs, shoulder delineators or beam guard in place along the traveled roadways without the approval of the engineer.

The traffic requirements are subject to change at the direction of the engineer in the event of an emergency.

Replace 643.3.1 (6) of the standard specifications with the following:

Provide 24-hour a day availability of equipment, forces and materials to promptly restore barricades, lights, or other traffic control devices that are damaged or disturbed. Restore and barricade, light, or other traffic control so that the device is not out of service for more than two hours.

SPECIAL PROVISIONS

GMIA Perimeter Road Bridge Over Howell Avenue

Definitions

The following definitions shall apply to this segment:

Peak Hours:

•6:00 AM to 9:00 AM Monday, Tuesday, Wednesday, Thursday and Friday
•2:00 PM to 6:00 PM Monday, Tuesday, Wednesday, Thursday and Friday
•10:00 AM to 1:00 PM Saturday

Off-Peak Hours:

•9:00 AM to 2:00 PM Monday, Tuesday, Wednesday, Thursday and Friday
•6:00 PM Monday to 6:00 AM Tuesday, 6:00 PM Tuesday to 6:00 AM Wednesday, 6:00 PM Wednesday to 6:00 AM Thursday, 6:00 PM Thursday to 6:00 AM Friday
•6:00 PM Friday to 10:00 AM Saturday
•1:00 PM Saturday to 6:00 AM Monday

Highway Work Restrictions

Two lanes of the STH 38 shall be entirely clear and open to traffic at all times except for approved Off-Peak Hour closures as approved by the engineer. Single lane operation is only permitted during Off-Peak Hours pending approval of the engineer. No part of a traffic drum shall be within a live traffic lane. Lane closures shall be in accordance to the standard detail drawings (SDD) and have the approval of the engineer and the WisDOT Regional Work Zone Engineer (262) 548-6730).

Sidewalks shall remain open at all times unless otherwise approved by the engineer. Sidewalks may be temporarily closed for pedestrian safety during erection. Flagmen and proper signing shall be provided and approved by the engineer.

Advance Notification

Provide the project engineer with a schedule of lane closures for the following week by noon on Thursday of the previous week. In addition, provide the following minimum advance notification to the project engineer for incorporation into the Wisconsin Lane Closure System.

Lane Closures	3 business days

The project engineer shall enter the closure into the Wisconsin Lane Closure System. Notify the project engineer and WisDOT Regional Work Zone Engineer (262) 548-6730) if there are any changes in the schedule, early completions, or cancellations of scheduled work.

CONSTRUCTION STAGING PLAN BRIDGE

PHASE 1-CONSTRUCTION (BASE BID)

<u>STAGE 1:</u>
A temporary 22-foot wide roadway shall be constructed along the southern edge of the existing Citation Way. This roadway will provide enough space to construct the east portion of the newly realigned Citation

Way, and also keep traffic running on both directions during construction. Contractor shall provide access all times to the Airport entrance to the west during construction.

STAGE 2:
The proposed Citation Way shall be constructed during this stage. One outer lane shall be closed for northbound traffic on S. Howell Avenue to finish the curb & gutter along S. Howell Avenue. Meanwhile, local traffic shall use old Citation Way and temporary pavement during this construction.

STAGE 3A:

1.1. Howell Avenue shall be reconstructed to provide a median opening to the new Citation Way, and to allow utility repair work within the median area. The center pier structure shall be constructed during this stage. Utility work shall be completed prior to pier and median construction. Traffic shall be using the newly constructed Citation Way at this time. No left turn shall be allowed through the median opening during utility work, median repair, and ongoing traffic from the new Citation Way.

1.2.

1.3. Excavate unsuitable material and prepare foundation for east portion of Perimeter Road. All grading work including GMIA drainage ditch grading shall be completed during this stage. The inner two lanes shall be closed on S. Howell Avenue. Two-lane closure will only be allowed during off peak hours.

1.4.

1.5. A Changeable Message Sign shall be installed in advance at two major intersections that are north and south of the construction zone to make drivers aware of expected delays ahead due to the closure of two lanes on S. Howell Avenue.

STAGE 3B:
Excavate unsuitable material and prepare foundation for west portion of Perimeter Road. All grading work including GMIA drainage ditch grading shall be completed during Stages 3A and 3B. Construct temporary construction access road from Howell Avenue. Place culvert under west MSE wall. The outer two lanes shall be closed on S. Howell Avenue. Two-lane closure will only be allowed during off peak hours.

1.6. A Changeable Message Sign shall be installed in advance at two major intersections that are north and south of the construction zone to make drivers aware of expected delays ahead due to the closure of two lanes on S. Howell Avenue.

STAGE 4:
East and west abutment structure shall be completed during this stage. Construct curb & gutter on west side of Howell Avenue. The outer one lane shall be closed for northbound as well as for southbound traffic on S. Howell Avenue.

Sidewalks shall remain open at all times unless otherwise approved by the engineer. Sidewalks may be temporarily closed for pedestrian safety during erection. Flagmen and proper signing shall be provided and approved by the engineer.

CONSTRUCTION (BID ALTERNATE 1)

The girders shall be placed during the night time. The opposite direction traffic shall be maintained during placement of girders. The lanes shall be temporarily closed to set and place the girders between abutments and the pier and the blocked traffic should be released between placing each girder for reasonable amount of time. The Airport Authority should be contacted in advance to inform about the placement of the girder. Emergency response team should be alerted so that the team can respond in case of emergency.

STAGE 5A:

The two outer lanes for northbound traffic on S. Howell Avenue shall be closed for deck forming work. Half of the deck forming along the east side shall be completed above the northbound closed lanes. All southbound traffic lanes shall remain open during this construction.

STAGE 5B:

Lane closure shall be switched and the two inner lanes for northbound traffic on S. Howell Avenue shall be closed for deck forming work. Half of the remaining deck forming along the east side shall be completed above the northbound closed lanes. All southbound traffic lanes shall remain open during this construction.

STAGE 5C:

The two inner lanes for southbound traffic on S. Howell Avenue shall be closed for deck forming work. Half of the deck forming along the west side shall be completed above the southbound closed lanes. All northbound traffic lanes shall remain open during this construction.

STAGE 5D:

Lane closure shall be switched and the two outer lanes for southbound traffic on S. Howell Avenue shall be closed for deck forming work. Half of the remaining deck forming along the west side shall be completed above the southbound closed lanes. All northbound traffic lanes shall remain open during this construction.

Two-lane closure will only be allowed during off peak hours. Sidewalks shall remain open at all times unless otherwise approved by the engineer. Sidewalks may be temporarily closed for pedestrian safety during erection. Flagmen and proper signing shall be provided and approved by the engineer.

STAGE 6A:

The concrete shall be poured continuously to avoid cold joints. The lane switch required during the following stages shall be quick enough to avoid any cold joints.

The two outer lanes for northbound traffic on S. Howell Avenue shall be closed at a time for concrete work. Half of the deck along the east side shall be poured above the northbound closure for the two outer lanes. All three southbound traffic lanes shall remain open during this construction.

STAGE 6B:

Lane closure shall be switched to close the two inner lanes for concrete work on half of the remaining deck area between the pier and previously poured area above the northbound traffic lanes. All three southbound traffic lanes shall remain open during this construction.

STAGE 6C:
The two inner lanes for southbound traffic on S. Howell Avenue shall be closed for concrete work. Half of the deck adjacent to the pier on the west side shall be poured above the northbound closure for the two inner lanes. All three southbound traffic lanes shall remain open during this construction.

STAGE 6D:
Lane closure shall be switched and the two outer lanes shall be closed for concrete work on half of the remaining deck area between the poured area and the west abutment above the southbound traffic lanes. All three northbound traffic lanes shall remain open during this construction.
Two-lane closure will only be allowed during off peak hours. Sidewalks shall remain open at all times unless otherwise approved by the engineer. Sidewalks may be temporarily closed for pedestrian safety during erection. Flagmen and proper signing shall be provided and approved by the engineer.

STAGE 7A:
The two outer lanes for northbound traffic on S. Howell Avenue shall be closed for bridge staining work. Staining of half of the bridge super structure along the east side shall be completed above the northbound closed lanes. All southbound traffic lanes shall remain open during this construction.

STAGE 7B:
Lane closure shall be switched and the two inner lanes for northbound traffic on S. Howell Avenue shall be closed for staining of super structure and east portion of pier. Staining of half of the remaining super structure and east portion of the pier shall be completed above the northbound closed lanes. All southbound traffic lanes shall remain open during this construction.

STAGE 7C:
The two inner lanes for southbound traffic on S. Howell Avenue shall be closed for bridge staining work. Staining of half of the super structure and pier along the west side shall be completed above the southbound closed lanes. All northbound traffic lanes shall remain open during this construction.

STAGE 7D:
Lane closure shall be switched and the two outer lanes for southbound traffic on S. Howell Avenue shall be closed for bridge staining work. Staining of half of the remained super structure long the west side shall be completed above the southbound closed lanes. All northbound traffic lanes shall remain open during this construction.
All restoration and clean up shall also be completed during this final stage.
Two-lane closure will only be allowed during off peak hours. Sidewalks shall remain open at all times unless otherwise approved by the engineer. Sidewalks may be temporarily closed for pedestrian safety during erection. Flagmen and proper signing shall be provided and approved by the engineer.
A Changeable Message Sign shall be installed in advance at two major intersections that are north and south of the construction zone to make drivers aware of expected delays ahead due to the closure of two lanes on S. Howell Avenue.

Runway Bridge Repair (BID ALTERNATE 2)
Repairs on the median wall and half of the ceiling of the Runway Tunnel shall be performed during this phase. The inner two lanes shall be closed on S. Howell Avenue and be extended further north beyond

the tunnel to accommodate Runway Tunnel work. This work shall have the same Traffic Control setup as Stage 3A, and may be done concurrently with the utility work and pier construction of the Phase 1 Construction Base Bid.
The repairs on the outer wall and the remaining half of the ceiling of the Runway Tunnel shall be performed during this phase. The outer two lanes shall be closed on S. Howell Avenue. This work shall have the same Traffic Control setup as Stage 3B, and may be done concurrently with the East Perimeter Road Construction of the Phase 1 Construction Base Bid.
Two-lane closure will only be allowed during off peak hours. Sidewalks shall remain open at all times unless otherwise approved by the engineer. Sidewalks may be temporarily closed for pedestrian safety during erection. Flagmen and proper signing shall be provided and approved by the engineer.
A Changeable Message Sign shall be installed in advance at two major intersections that are north and south of the construction zone to make drivers aware of expected delays ahead due to the closure of two lanes on S. Howell Avenue.

Security Fences and Road Work Completion (BID ALTERNATE 3)

Modify east and west security fences as proposed. Add a new gate at the intersection of the Perimeter Road and Citation Way. Construct Mechanically Stabilized Earth Walls fascia panels on Perimeter Road. Complete GMIA Perimeter road and associated drainage structures during this final phase of the work. Construct the proposed two access roads to the existing airport facility as per plan. Remove the temporary construction access road. No traffic control is anticipated on Howell Avenue during this phase of the work

24. Utilities

This project does not fall under the provisions of TRANS 220 Rule.

Both underground and aerial utility facilities are located within the project limits. The contractor shall coordinate construction activities with Diggers Hotline and/or contact directly the utilities in the project area, as required per statutes. The contractor shall use caution to insure the integrity of the underground facilities and maintain OSHA code clearance from overhead facilities at all times.
The utility adjustments will be incorporated into the Contractor's construction project schedule. The Contractor shall coordinate with the Utility companies to allow for the adjustments to be made in cooperation with planned grading and other underground work.

WE Energies
WE Energies has underground facilities on the east and west sides of the project limits, and an overhead line on the east side along Howell Avenue. There is an underground electric line running parallel with the existing Citation Way along its south side. WE Energies will bore and/or trench to relocate this facility prior to construction in order to avoid conflict with the proposed MSE wall. The underground electric line running across the proposed Perimeter Road on the west side will also be trenched deeper or relocated prior to construction to avoid conflict with the MSE wall. The overhead lines along the east curb of Howell Avenue will need relocating. Two poles with guy wires will be moved. Prior to construction of the new Citation Way, the northernmost guy pole will be removed and the pole just south of it will be a temporary guy pole. During construction of Citation Way, that pole will be removed and the guy wires will be moved to the pole south of the existing Citation Way and new Perimeter Road/Bridge. Any electric going north to the airport will not be overhead, it will be underground and under the bridge, along the east terrace in front of the east abutment. The transformer located near STA 11, approximately 11 feet off of the back of curb of the proposed Citation Way will need to be relocated prior to construction.

The timing, payment and coordination of the We-Energies relocations will be the sole responsibility of the Contractor. Costs for these relocations will be reimbursed to the Contractor through payment within the Utility Allowance Bid Item. Contractor to submit copies of all relocation bills from We-Energies to the Resident Engineer or appropriate County contact in order for these costs to be included on the periodic pay applications.

The underground electric line at the intersection of the new Citation Way and Perimeter Road is deep enough to avoid conflict. Also, there should not be any conflict with the underground electric at STA 13+50 under the new Citation Way due to the construction of Citation Way being mainly a fill project with a maximum anticipated excavation of only 18 inches. The underground electric line running north/south behind the west curb of Howell Avenue will not need to be relocated as it is not far enough back to conflict with the west abutment. There is an underground gas main on the east side running parallel with Howell Avenue that is buried deep enough to avoid any conflict. That gas main makes a T and runs parallel with the existing Citation Way, but it also deep enough to avoid any conflict. There are no gas main utilities that require relocation.

The WE Energies contact for electric facilities is: Ken Franecki, 500 S. 116th St., West Allis, WI 53214, (414)944-5531, kenneth.franecki@we-energies.com

The WE Energies contact for gas main facilities is: Brandon Erts, (414)-944-5767, Brandon.erts@we-energies.com

City of Milwaukee Utilities

The City of Milwaukee Utilities will provide plan and specifications to the contractor prior to start of construction. Contractor shall provide allowance for estimated quantities of 127’ of 8-inch DIA Sanitary Relay, Class “C” Bedding, 240’ of 21-inch DIA Sanitary Relay, Class “C” Bedding sewer removal, four 4’ DIA Sanitary Manholes with internal Manhole Seals, 1 LS Barricading, 1 LS Erosion Control, 1 LS Bulkhead and Abandon approximately of 8-inch DIA and 21-inch DIA sanitary sewers, abandon 2 sanitary manholes, 240 SY of 3” Asphaltic Pavement, 240 SY Concrete Base, and 500 LF Sewer Exams by CCTV post construction. The City Underground Conduit and Street Lighting estimate of quantities include 2 Manholes Type Tes 4’ DIA, 75’ of 1-Duct Cement Encased, 4-inch Conduit, 170’ of 5-Duct Cement Encased, 4-Inch Conduit, 350’ of 4-Duct Cement Encased, 4 inch conduit, 100’ of Condit Rigid Nonmetallic Schedule 40 3-inch, and 3 each of Polymer Concrete Vault 13”x24”x18”

Before the contractor starts the City street lighting forces will be installing a new aluminum light pole in the center island at sta. 404+48.43. The contractor to install the duct package stub and pipe crossing approximately 5 ft. north of pole location.

After the new conduit package, pipe crossings, and vaults have been installed by contractor the City street lighting forces will be doing the following:

1.) Installing two wood poles one on each side of Howell Ave. located at the pipe crossings.

2.) String temporary overhead cable from the wood poles to the next four (4) light poles to the North.

3.) Install additional conduit that will be connected to the vaults.

4.) Install cable through vaults, duct package, and pipe crossings

5.) Make the connections and splices needed to put the new circuitry into service.

6.) Remove the two (2) light poles at approximately sta. 403+20 & sta. 404+36

City Sanitary Sewer has a 21" sanitary sewer line that runs north/south in the middle of Howell Avenue, and an 8" sanitary sewer line that runs east/west across the proposed median in Howell Avenue. These sanitary sewers require relocation which will be performed during construction by the Contractor, and inspected by The City. The City will design these sanitary sewer.

Once the plans, specifications and quantities are received from the City of Milwaukee for this work, prices for their respective pay items will be negotiated with the Contractor and added to the contract via change order. The cost for this change order utility work will be paid through the Utility Allowance Item as described in Section 22.

The City owned sewer line behind the west curb of Howell Avenue does not require relocation as it is not far enough back to conflict with the west abutment. There is also a 12'' sanitary sewer line north of the proposed Citation Way that does not require relocation.

The City of Milwaukee contact for these facilities is: Rattan Mahay, 841 N. Broadway, Milwaukee, WI 53202, (414)286-0486, rattan.mahay@milwaukee.gov

City Underground Conduit has one buried cable within the project limits that will need relocation. If this cable is to be relocated underneath pavement, it will require 4" concrete encased conduit. The relocation of this cable will take place during the construction of the bridge pier with the encased conduit work provided and installed by the contractor. The City will design and inspect relocations and will provide plans and specifications to the contractor prior to start of construction. These plans are anticipated to include 4" concrete encased conduit.

Once the plans, specifications and quantities are received from the City of Milwaukee for this work, prices for the respective pay items will be negotiated with the Contractor and added to the contract via change order. The cost for this change order utility work will be paid through the Utility Allowance Item as described in Section 22

The City of Milwaukee Underground Conduit contact is: Karen Rogney, (414)286-3243, Karen.rogney@milwaukee.gov

City Street Lighting

personnel will design, provide temporary service, and relocate street lighting on H Street lighting personnel will install temporary overhead facilities and relocate permanent facilities, as needed, before roadway and bridge construction starts. During and after roadway construction Street Lighting forces will install permanent lighting facilities.

The engineer and contractor shall keep the Street Lighting Construction supervisors informed of the status of the roadway construction. Contact Mr. George Berdine at 414-286-5943 office, 414-708-4245 cell or Mr. Dennis Miller at 414-286-5942 office 414-708-4251 cell. If neither Mr. Miller nor Mr. Berdine is available, then contact our dispatcher at 414-286-5944

The contractor must keep the area behind the curb free from over pour and other debris.

If the contractor requests the relocation of any street lighting facilities, permanent or temporary for his convenience he will be responsible for all costs incurred by Street Lighting personnel fulfilling his request

SPECIAL PROVISIONS

GMIA Perimeter Road Bridge Over Howell Avenue

The contractor may NOT start construction on the bridge until the street lighting circuitry is installed and rerouted through the new multi-duct package, and is fully operational.

The contractor may NOT start until the street lighting overhead circuitry is fully operational.

If the contractor starts before the circuitry is fully operational, he will be responsible for all damages to lighting facilities.

If contractor installs any conduit or vaults for street lighting, it must be installed after the curb is in.

Any questions regarding the design of the lighting system are to be directed to Street Lighting engineering. Contact Mr. Tom Manzke at 414-286-3265 or Mr. Denis Kozelek at 414-286-3252 Howell Avenue prior and during construction by City forces.

The City of Milwaukee Street Lighting contact is: Denis Kozelek, 841 N. Broadway, Milwaukee, WI 53202, (414)286-3252, denis.kozelek@milwaukee.gov

City Communications has one copper cable (204B) in Howell Avenue from Grange Avenue to College Avenue. There is a Street Light Control Circuit 1 and one Police Call box at College and Howell. They will disconnect service on this cable for the length of the project and reconnect them once the project is complete. Street Lighting should be notified so they can install a timer for the lights and the Police call box will remain out of service until the project is complete. It is requested that conduit be installed in the project area for their cable to be routed through once the project is completed.

The City of Milwaukee contact for these utilities is: Rattan Mahay, 841 N. Broadway, Milwaukee, WI 53202, (414)286-0486, rattan.mahay@milwaukee.gov

City Water has an underground water main running north/south behind the west curb of Howell Avenue. There is also a branch from that line that runs perpendicular to Howell Avenue at STA 404+40. These facilities do not require relocation.

The City of Milwaukee contact for these facilities is: Tony Fahres, (414)286-2428, anthony.fahres@milwaukee.gov

MWFN has one underground fiber optic line within the project limits. This line is located behind the east curb of Howell Avenue. This facility will not require relocation or removal since it is buried at least 36" deep, and excavation for the new Citation Way will only be about 18 inches.

The MWFN contact is: Richard Trgovec, 3701 Burnham St, Milwaukee, WI 53215, (414)672-5612, rtrgovec@midwestfibernetworks.com

MMSD has a 27" MIS line running north/south behind the west curb of Howell Avenue. A manhole associated with this facility is in line with the proposed Perimeter Road, but it is not far enough back to conflict with the construction of the west abutment. MMSD has no need for relocations.

The MMSD contact is: Debra Jensen, 260 W. Seeboth St., Milwaukee, WI 53204, (414)225-2143, djensen@mmsd.com

The MMSD contact for piling and deep foundation work is: Larry Anderson, 260 W. Seeboth St., Milwaukee, WI 53204, O:(414)225-2241, C☹414)617-1429, landerson@mmsd.com

WisDOT has a storm sewer within the median below the proposed pier, and an inlet catch basin at the proposed intersection location. Relocation of these facilities will take place during roadway construction, as part of the roadway construction by the contractor.

WisDOT utility contact is: Janet Cannon, (262)548-6890, janet.cannon@dot.wi.gov

Milwaukee County has an 8" water main running perpendicular with Howell Avenue and parallel with the existing Citation Way. This facility requires relocation as it crosses under the location of the proposed bridge pier. This facility will be relocated during roadway construction, as part of the roadway construction by the contractor. The County and/or its contractor shall pay all fees associated with connecting to the City water main, and shall construct a new meter pit, if necessary. The County also owns a 10" Sanitary Sewer line that runs perpendicular with Howell Avenue and parallel with the existing Citation Way. This sewer line also requires relocation as it crosses under the proposed bridge pier. This facility will be relocated during roadway construction, as part of the roadway construction by the contractor. The County owned existing storm sewer facilities near Citation Way will be abandoned by the contractor during construction. The County owned street lighting facilities will be relocated during construction by the contractor.
The Milwaukee County contact is: Karl Stave, (414)298-4863, kstave@milwcnty.com

AT&T has underground telephone lines parallel to Howell Avenue on the east side, passing underneath the existing and proposed Citation Way. One of the lines makes a T north of the existing Citation Way and runs parallel with Citation Way towards the east. South of the proposed bridge pier there is an overhead cable running across Howell Avenue. These facilities do not require relocating.

The AT&T utility contact is: Mark Eder, 2005 Pewaukee Rd., Waukesha, WI 53188-2443, (262)896-7434, me1754@att.com.

FAA has underground facilities on the west side of Howell Avenue near STA 512+90, underneath the proposed MSE wall. These facilities will be relocated near the westerly end of Perimeter Road to STA 510+50 during construction. These existing FAA lines service instruments and radar that are critical to the operations of the Airport and must remain in complete operation at all times during construction. No work affecting the existing FAA lines shall be started until the new lines have been relocated, spliced over and in complete working order as approved by the appropriate FAA contacts.

The local FAA Technical Operations contract is Joseph Lawrence, (414) 489-2201, Joseph.Lawrence@faa.gov or Robert Baker, (414) 489-2211, Robert.A.Baker@faa.gov

STANDARD SPECIFICATIONS
INDEX
FOR
GMIA – PERIMETER ROAD BRIDGE OVER HOWELL AVENUE

Contents

ITEM	DESCRIPTION	PAGES
ITEM M-1 MOBILZATION		2
ITEM W616.0212.S FENCE CHAIN LINK, 12 FOOT		4
ITEM W616.0329.S FENCE CHAIN LINK, 30 FOOT		5
ITEMS W616.0213S, W616.0329.S TEMPORARY CHAIN LINK FENCING AND GATES, 8-FOOT		6
ITEM W616.0214S TEMPORARY FENCE-DITCH CROSSING		8
ITEM 659.0215 LUMINAIRES UNDERDECK 150 WATTS		9
ITEM SPV.0035.01 FLOWABLE FILL		10
ITEM SPV.0035.02 VEGETATED SWALE		12
ITEM SPV.0060.01 JUNCTION BOXES 8X884-INCH		13
ITEM SPV.0060.02 JUNCTION BOXES 12X12X8-INCH		13
ITEM SPV.0060.03 THROUGH SPV.0060.08 PRECAST MANHOLE		14
ITEM SPV.0060.09 THROUGH SPV.0060.10 MANHOLE AND INLET COVERS		16
ITEM SPV.0060.11 POLYMER CONCRETE VAULT		17
ITEM SPV.0090.02 VENT TUNNEL EXPANSION JOINT REPAIR		20
ITEM SPV.0090.03 PRECAST CONCRETE BOX CULVERT 6-FT X 6-FT		22
ITEM SPV.0165 PRESTRESSED PRECAST CONCRETE WALL PANEL		25
ITEM SPV.0165.01 CONCRETE STAINING TUNNEL		32
ITEM SPV.517.1010.S CONCRETE STAINING BRIDGES & WALLS		34
ITEM SPV.532.0700S WALL WIRE FACED MECHANICALLY STABILIZED EARTH		37
ITEM SPV.550.2102.S PILING STEEL HP 12X53		43
ITEM L-110 ELECTRICAL DUCT BANK		66
ITEM L-115 ELECTRICAL HANDHOLES AND JUNCTION STRUCTURES		71
ITEM L-152 FIBER OPTIC CABLE		80
ITEM L-155 EQUIPMENT RACK		89
ITEM L-156 LOCKABLE HANDHOLE		92
ITEM L-157 RTR CABLE		95
ITEM P-610 PORTLAND CEMENT CONCRETE		99
ITEM 323119 GATES OPERATOR		107
ITEM D555 DIRECTIONAL BORING		114
F-162 CHAIN LINK FENCE GATES		121
ITEM X162-5.1, X162-5.2, X162-5.3		125
TEMPORARY CHAIN LINK FENCING AND GATES, 8 FOOT		125
CONDUIT RIGID NONMETALLIC SCHEDULE 40 3-INCH, ITEM 652.0235		127

ITEM M-1 MOBILZATION

1. DESCRIPTION

1.1 This item shall consist of the work and operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site and for establishment of all Contractor's construction facilities, temporary pollution control measures, barricades, staging area improvements, sanitary and other facilities necessary for work on the project; and of all other work and operations which must be performed or for which costs must be incurred before beginning work on the various items on the project site and throughout the duration of each alternative. This item shall include all items of work (including the submission of documentation, such as the Contractor's construction schedule, erosion control plan, etc.) as required in these contract documents and not otherwise included in other bid items. This item shall also include the costs associated with obtaining airport identification badges, and attending the required airfield safety and security training.

1.2 See Special Provisions for additional barricade and traffic control specifications and requirements.

2. METHOD OF MEASUREMENT

2.1 Mobilization will be measured for payment as a single complete unit of work for each alternative, acceptably performed.

This item of work, measured as provided herein, will be paid for at the contract lump sum price for Mobilization, which price shall be full compensation for supplying and furnishing all materials, labor, facilities and services, and for performing all work necessary for the completion of the work under each alternative as found in these documents.

The contract lump sum amounts for each mobilization item shall be payable to the Contractor in accordance with the following schedule:

When five percent or more of the contract amount within each alternative is earned, 25 percent of the amount bid for mobilization will be paid.

When 25 percent or more of the contract amount within each alternative is earned, 50 percent of the amount bid for mobilization will be paid.

When 50 percent or more of the contract amount within each alternative is earned, 75 percent of the amount bid for mobilization will be paid.

When 75 percent or more of the contract amount within each alternative is earned, 100 percent of the amount bid for mobilization will be paid.

3. BASIS OF PAYMENT

3.1 Mobilization shall be paid for at the contract lump sum price per alternative, in accordance with the above payment schedule. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
Item M -1	Mobilization	- per Lump Sum

END OF SECTION ITEM M-1 MOBILIZATION

ITEM W616.0212.S FENCE CHAIN LINK, 12 FOOT

1. DESCRIPTION

This specification describes the furnishing and installing 12-foot chain link fence at the locations and per the details shown in the plans.

2. MATERIALS

Use fence chain link conforming to Section 616 of WisDOT Standard Specifications and per the details shown in the plans.

3. CONSTRUCTION

Meet the pertinent requirements as set forth in section 616 of the WisDOT Standard Specifications and shall be installed at the locations and in accordance with the plan details.

4. MEASUREMENT

Fence Chain Link 12 FT will be measured by the lineal foot installed and in accordance with the contract.

5. PAYMENT

Measured quantities shall be paid at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
W616.0212S	Fence Chain Link 12-FT	LF

Payment is full compensation for furnishing, transporting, and installing the fence system; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

END OF SECTION ITEM W616.0212 FENCE CHAIN LINK, 12 FOOT

ITEM W616.0329.S FENCE CHAIN LINK, 30 FOOT

1. DESCRIPTION

This specification describes the furnishing and installing of 30-foot chain link crash gates at the locations and per the details shown in the plans.

2. MATERIALS

Use fence chain link conforming to Section 616 of WisDOT Standard Specifications and per the details shown in the plans.

3. CONSTRUCTION

Meet the pertinent requirements as set forth in section 616 of the WisDOT Standard Specifications and shall be installed at the locations and in accordance with the plan details.

4. MEASUREMENT

Gate Chain Link 30 FT will be measured by the unit each and in accordance with the contract.

5. BASIS OF PAYMENT

Measured quantities shall be paid at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
W616.0329.S	Gates Chain Link 30-FT	EACH

Payment is full compensation for furnishing, transporting, and installing the fence gate system; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

END OF SECTION ITEM W616.0329.S FENCE CHAIN LINK, 30 FOOT

ITEMS W616.0213S, W616.0329.S TEMPORARY CHAIN LINK FENCING AND GATES, 8-FOOT

Work under this item shall conform to the requirements of Section 616 of the Standard Specifications for Highway and Structure Construction, and supplemented as follows:

A. Description.

This work shall consist of installing temporary chain link fencing, barbed wire and 30' wide crash gates at the locations shown on the plans and according to the phasing and specifications of the project. At completion of their use, these items shall also include the removal of the temporary fencing and gates, grading and restoration of vegetation.

B. Materials.

All materials shall conform to the requirements as specified in Section W 616 with the following allowed exceptions.

(1) At the Contractor's option, fencing fabric line posts and barbed wire removed from other areas of the airport may be salvaged for re-use as the temporary fence.

(2) Regardless of whether the temporary fence consists of new or salvaged materials identified above, the contractor shall provide new corner posts, bracer posts, and terminal posts in accordance with the alignment of the temporary fence shown on the plans. The posts shall be of the same material specified for new chain link fence. Line posts do not need to be set in concrete, but shall be driven to a 4' minimum depth to allow the fence fabric to be tensioned and secured. No separate payment will be made for these new posts, anchoring or any other incidentals necessary to install the new or salvaged material used for temporary fence.

C. Construction Methods.

(1) Contractor shall maintain secured fencing and gates around project work areas at all times.

(2) No existing perimeter fencing shall be removed in a manner to impact security until the temporary security fencing has been installed in its final location.

(3) Temporary fencing shall tie to the existing perimeter fence at a newly constructed terminal post. The Contractor shall fill any resulting gaps between the temporary fence and the existing perimeter fence by wiring a section of chain link fabric between the two fence sections.

(4) For locations where the temporary fencing and gate posts will cross existing pavement, the Contractor shall core a 6" diameter hole to receive the line post.

(5) Upon installation of the final security fencing, the temporary fencing and gates shall be removed along with any posts, wires or associated materials and the area re-graded and seeded to the satisfaction of the engineer.

(6) Temporary fence or gates posts located in existing pavement shall be filled with hot mix asphalt pavement, Type E-3, upon removal or concrete as directed by the engineer.

D. Method of Measurement.

Temporary chain link fence will be measured for payment in its final installed locations, by linear foot. Temporary Gate Chain Link 30 FT will be measured by the unit each, measured in their final locations and in accordance with the contract.

E. Basis of Payment.

All labor equipment and materials required to complete this work shall be considered incidental to this item.

ITEM NUMBER	DESCRIPTION	UNIT
W616.0213.S	Temporary Chain Link Fence, 8-Foot	per linear foot
W661.0329.S	Temporary Gate Chain Link 30-Ft	per each

END OF SECTION TEMPORARY CHAIN LINK FENCING AND GATES, 8-FOOT, BID ITEMS NO. W616.0213S, W616.0329.S

ITEM W616.0214S TEMPORARY FENCE-DITCH CROSSING

Work under this item shall conform to the requirements of Section 616 of the Standard Specifications for Highway Construction and those stated below.

A. Description

This item shall consist of furnishing and constructing a temporary fence-ditch crossing where indicated on the plans. This item shall be constructed according to the details and at the locations shown in the plans.

B. Materials

All materials used for the construction of the temporary ditch crossing shall be of the same type of material as used in the fence. All materials shall meet or exceed those called out on the details specified in the plans.

C. Construction Methods

Due to the variation of width and depth, a variety of post lengths and quantity may be encountered. Contractor is to ensure that the vertical clearance between sections of brace bars shall be 6 inches or less. At no point within the creek crossing shall there be an opening greater than 6" vertical.

D. Basis of Payment

Payment for Temporary Fence-Ditch Crossing shall be at the contract unit price per linear foot. The price shall be full compensation for all materials, labor, equipment, tools, and incidentals necessary to complete the item, as detailed on the plans.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
W616.0214S	Temporary Fence-Ditch Crossing	per linear foot

END OF SECTION TEMPORARY FENCE-DITCH CROSSING, BID ITEM NO. W616.0214S

ITEM 659.0215 LUMINAIRES UNDERDECK 150 WATTS

Conform to Section 659 of the State of Wisconsin Standard Specifications for Highway and Structure Construction, 2012 Edition except as modified in this special provision.

Subsection 659.2.1 of the standard specifications is deleted and replaced with the following.

(1) Use the following products, or an approved equal, for the luminaire underdeck 150 watts bid item.

Product Name	Product Identification	Producer
Underpass Series 581/681	581-15S-XH-240-NC-LC-SS-SE	American Electric Lighting
Wallmount 175 Luminaire	WM7M-15S-3-H1-SN4-DB	GE Lighting Solutions
Perimaliter Wallpack	PGM3-150P-18-BZ	Hubbell Outdoor Lighting
Wall Pak	WPM-2-5-9-LS-240-H	North Star Lighting

END OF SECTION ITEM 659.0215 LUMINAIRES UNDERDECK 150 WATT

ITEM SPV.0035.01 FLOWABLE FILL

1. DESCRIPTION

This section describes controlled low strength concrete (Flowable Fill) manufactured and delivered to a purchaser in a freshly mixed and unhardened state. Flowable Fill shall meet the requirements provided in section 501 and 502.

2. MATERIALS

The CONTRACTOR shall submit a mix design of the proposed Flowable Fill materials. Flowable Fill shall be proportioned by the concrete supplier on the basis of field experience and laboratory trial mixtures to produce a cohesive and non-segregating mixture meeting the specified properties. Flowable Fill shall be proportioned with cementitious materials, such as hydraulic cement, fly ash and slag, fine aggregates, water and chemical admixtures. Flowable Fill shall be proportioned to allow transport by pumping methods without segregating or excessive bleeding.

Flowable Fill shall meet the requirements listed below.

Slump (Max) – 6 to 8 inches

Unit Weight – 140 to 145 lb/ft3

Water/Cement Ratio – 0.7

28-Day Compressive Strength – 300 to 1,200 psi

Flowable Fill shall be manufactured with materials conforming to the standards listed below.

Hydraulic Cement - AASHTO M 85 or M 240

Fly Ash - AASHTO M 295

Granulated Blast Furnace Slag - AASHTO M 302

Fine Aggregate - AASHTO M 6

Coarse Aggregate - AASHTO M 80

The CONTRACTOR shall submit independent field lab testing as follows:

Sampling - ASTM D 5971

Compressive Strength – ASTM D 4832

Unit Weight - ASTM D 6023

Flowability - ASTM D 6103

Air Content - ASTM D 6023

3. CONSTRUCTION

Construction shall meet the requirements of section 501 and 502. Placement of Flowable Fill shall be completed with extreme care and shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of sections 501 and 502. No relaxation of requirements to accommodate Flowable Fill will be permitted.

4. MEASUREMENT

The department will measure the quantities for Flowable Fill that is acceptably completed according to the contract provision by the cubic yard.

5. BASIS OF PAYMENT

The department will pay for measured quantities at the contract unit price under the following bid items:

Item Number	Description	Unit
SPV.0035.01	Flowable Fill	CY

Payment is full compensation for providing mix design, independent material testing, providing, forms, placing concrete, finishing, curing, protecting, and measures necessary for cold and hot weather conditions.

END OF SPV.0035.01 FLOWABLE FILL

ITEM SPV.0035.02 VEGETATED SWALE

1. DESCRIPTION

This special provision describes the furnishing, excavating, grading and seeding of vegetated swale.

2. MATERIALS

The Vegetated Swale shall be seeded with NO. 80 Wisconsin DOT native plant mix. The engineered soil shall be composed of 75% sand and 25 % compost. The gradation requirements shall meet USDA Coarse Sand (0.2-.04) or ASTM C33 (Fine Aggregate Concrete Sand). The compost shall meet Wisconsin Department of Natural Resources Specification S100 Compost. The engineered soil shall be free of rocks, stumps, roots, brush or other material over 1 inch in diameter. A 3-inch interface layer shall be below the engineered soil. The interface shall be a 50/50 mixture of native soil and engineered soil. The engineered soil mix shall have a pH value range between 5.5 and 6.5. Mulch shall be composed of shredded hardwood.
.

3. CONSTRUCTION

Construction shall be suspended during periods of rainfall or snowmelt. Compaction of engineered soil shall be minimized. Excavate two feet below proposed grade and back-fill with engineered soil, covered with a 3- inch mulch layer. Area of proposed vegetated swale shall be cordoned to prevent access by heavy vehicle. The soil shall be re-fractured to a depth of at least 12 inches if compaction occurs. The engineered soil shall be placed in multiple lifts with a maximum of 12 inches per lift. Vibrating plate-style compactors shall not be used to induce settling of engineered soil.

4. MEASUREMENT

Engineered soil shall be measured by the cubic yard of material placed and accepted.

5. PAYMENT

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SP.0035.02	Vegetated Swale	CY

Payment is full compensation for designing the mix, supplying all materials scribed above including mulch and construction of vegetated swale.

END OF SECTION ITEM SPV.0035.02 VEGETATED SWALE

ITEM SPV.0060.01 JUNCTION BOXES 8X884-INCH
ITEM SPV.0060.02 JUNCTION BOXES 12X12X8-INCH

Materials and construction for junction boxes shall be completed in accordance with Section 653 of the State of Wisconsin Standard Specifications for Highway and Structure Construction, 2012 Edition.

4. MEASUREMENT

The department will measure all the bid items under this section as each individual box acceptably completed.

5. BASIS OF PAYMENT

General
The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM	DESCRIPTION	UNIT
SPV.0060.01	Junction Boxes 8x8x4-Inch	EACH
SPV.0060.02	Junction Boxes 12x12x8-Inch	EACH

Payment for the junction boxes bid items is full compensation for providing all materials including grounding lugs and stainless steel mounting hardware. Electrical wiring is not required for this contract.

END OF SECTION ITEM SPV.0060.01 AND SPV.0060.02.

ITEM SPV.0060.03 THROUGH SPV.0060.08 PRECAST MANHOLE
MANHOLE 1, MANHOLE 2, MANHOLE 3, MANHOLE 4, MANHOLE 5, MANHOLE 6, MANHOLE 6A

1. DESCRIPTION

This section describes constructing, manholes, inlets and similar structures, made of precast concrete with necessary reinforcement, metal frames, grates and lids, including required excavating, backfilling, joints and connections.

Structural design and final product shall be provided by the precast supplier. Design and manufacturing practices shall be in compliance with ASTM C478, ASTM C913, ASTM C890, ACI 318-05, and ASCE 7-05. Supplier shall submit structural calculations prepared and sealed by a qualified engineer licensed in the State of Wisconsin. Supplier shall submit detailed shop drawings indicating size, structural section thicknesses, concrete design mixes, reinforcing materials and quantities. Loading and design criteria for each structure are as identified on the drawings.

2. MATERIALS

All materials shall be in conformance with Section 611.2 of the Standard Specifications. Sizes shall be as indicated on plans.

Granular Base shall be in accordance with Section 301 of the Standard Specifications.

3. CONSTRUCTION

All construction methods shall be in accordance with Section 611.3. All materials installed shall be in accordance with Section 611.3. Excavation shall be in accordance with Section 206. Foundation preparation shall be in accordance with Section 211.

Concrete bench and invert channel shall be troweled to a smooth, dense surface finish and a semicircular shape conforming to the inside of the adjacent pipe sections.

4. MEASUREMENT

The department will measure all the bid items under this section as each individual unit acceptably completed.

5. BASIS OF PAYMENT

General
The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM	DESCRIPTION	UNIT
SPV.0060.03	Manhole 1	EACH
SPV.0060.04	Manhole 2	EACH
SPV.0060.05	Manhole 3	EACH

SPV.0060.06	Manhole 4	EACH
SPV.0060.07	Manhole 5	EACH
SPV.0060.08	Manhole 6A	EACH

Granular backfill material required for backfilling and granular base material in accordance with Standard Specification 611.3 are incidental to the work. Chimney, pipe, and other connections to elements indicated are incidental to the work.

Manholes
Payment for the Manholes bid items is full compensation for providing all design and materials, including all masonry, conduit and sewer connections, steps and other fittings; for all excavating, backfilling, disposing of surplus material, and for cleaning out and restoring the work site; except that the department will pay for covers, including frames, grates and lids separately.

The department will apply contract unit prices without adjustment to the quantities of all manholes constructed to depths not greater than one foot above or below the elevations, the plans show. Manholes that the engineer orders constructed to depths greater than one foot above or below the elevations the plans show as specified for extra work.

Manhole Covers
Payment for the Manhole Covers and Inlet Covers bid items is full compensation for providing new covers, including frames, grates or lids, and all other required materials and for installing and adjusting each cover.

Adjusting Manhole Covers
Payment for Adjusting Manhole Covers is full compensation for providing all required materials, exclusive of frames, grates or lids available and designated for adjusting; and for removing, reinstalling and adjusting the covers. The contractor shall replace all covers to be adjusted and that are unusable due to the contractor's operations, at no expense to the department.

END OF SECTION ITEM SPV.0060.03 THROUGH SPV.0060.08 PRECAST MANHOLE

ITEM SPV.0060.09 THROUGH SPV.0060.10 MANHOLE AND INLET COVERS R-1916-F, R-2580-C, R-3492-1

1. DESCRIPTION

This section describes installing covers on manholes, structures, and/or inlets, as shown on the plans.

2. MATERIALS

All materials shall be in conformance with Section 611 of the Standard Specifications. Frame and cover shall be as designated in the plans and shall be Neenah Type R-1916-F, Neenah Type R-2580-C or Neenah Type R-3492-1. Equivalent frames and covers may be used.

3. CONSTRUCTION

Covers and frames shall be installed in areas as designated in the plans. Manufacturer's installation guidelines shall be followed during installation.

All installation methods shall be in accordance with Section 611.3, as appropriate.

4. MEASUREMENT

The department will measure all the bid items under this section as each individual unit acceptably completed.

5. BASIS OF PAYMENT

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM	DESCRIPTION	UNIT
SPV.0060.09	Manhole Cover – R-1916-F	EACH
SPV.0060.10	Manhole Cover – R-2580-C	EACH
SPV.0060.11	Manhole Cover – R-3492-1	EACH

Frame and cover shall be incidental to the installation. All bolts and associated parts necessary for installation shall be considered incidental.

END OF SECTION ITEM SPV.0060.09 THROUGH SPV.0060.10 MANHOLE AND INLET COVERS

POLYMER CONCRETE VAULT
13-INCH X 24-INCH X 18-INCH; ITEM SPV.0060.11

A. Description
This special provision describes furnishing and installing Polymer Concrete Vaults in accordance with current City of Milwaukee methods.

B. Materials
Polymer Concrete shall be manufactured from one of the general types and grades defined in polymers in concrete structural applications state of the art report, ACI 548.6R-96 for structural uses. Thermoplastics will not be acceptable.

Enclosure walls shall be made from pattern cut structural fiberglass cloths to assure uniform, pre-measurable fiberglass content on all areas. Chopper gun fiberglass construction is not acceptable.

Binding polymers used in the manufacture of the polymer concrete and the fiber reinforced polyester shall be of the same formulation or from formulations with demonstrated chemical compatibility to assure complete chemical bonding of all components. Fiber reinforced polyester wall sections must be cast integrally into and chemically bonded within the upper polymer concrete casting.

Compressive Modulus of Elasticity (fiberglass reinforced polymer): 5.6×10^6 PSI tested in accordance with procedures outlined in ASTM D-695

Comprehensive Strength (fiberglass reinforced polymer): 24,300 PSI tested in accordance with ASTM D-695

Flexural Strength (fiberglass reinforced polymer): 18,700 PSI tested in accordance with ASTM D-790

Tensile Strength (fiberglass reinforced polymer): 12,100 PSI tested in accordance with procedures outlined in ASTM D-638

Tensile Modulus of Elasticity (fiberglass reinforced polymer): 8.6×10^5 PSI tested in accordance with procedures outlined in ASTM D-638

Splitting Tensile Strength (polymer concrete): Tested in accordance with procedures outlined in ASTM C-496

Accelerated Service: Tested in accordance with procedure E outlined in ASTM D-756

Water Absorption: Tested in accordance with ASTM D-570 outlined in sections 6.1 and 6.5

Impact Resistance (fiberglass reinforced polymer concrete): 72 foot pounds in accordance with ASTM D-2444 administered with a “C” tup

Skid Resistance: 0.60 coefficient of friction in accordance with ASTM C-1028

Flammability Test: Tested in accordance with ASTM D-635

Ultraviolet Exposure: Tested in accordance with ASTM test method G-53

Chemical Resistance

1. Sodium Chloride 5%
2. Sodium Carbonate 0.1 N
3. Hydrochloric Acid 0.2 N
4. Acetic Acid 5%
5. Sulfuric Acid 0.1N
6. Sodium Sulfate 0.1 N
7. Sodium Hydroxide 0.1N
8. Kerosene Oil per ASTM D-543
9. Transformer Oil per ASTM D-543

The street lighting vaults and covers shall be gray in color and shall be flared wall as indicated on the Drawings. Covers shall be provided with 2 stainless steel bolts. Each cover shall have the words **"STREET LIGHTING"** cast into its surface along the longest dimension. The words shall be permanently recessed into the surface.

C. Construction

Install rectangular flared wall vaults according to current City of Milwaukee standards.
Provisions for inserting conduit into any side or the bottom of the vault shall be included.

D. Measurement

The Department will measure this item by the each (EACH) unit of measure.

E. Payment

The Department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.11	Street Lighting Polymer Conc. Vault 13-Inch x 24-Inch x 18-Inch	EACH

Payment is full compensation for furnishing labor, equipment, coordination and all materials and incidentals necessary to complete the work.

Underground enclosures must successfully pass numerous material and product performance tests before they can meet ANSI/SCTE 77-2002. These tests include:

- Three Position Load Testing to Simulate Actual Application
- UV Degradation per ASTM G-53
- Fire Resistance per RUS7CFR 1755.910 and WUC 3.6 Section 5.2.7
- Chemical Resistance per ASTM D-543

- Water Absorption per ASTM D-570
- Load and Deflection Requirements per SCTE Coaxial Practice, Section 5
- Impact Resistance per ASTM D-2444
- Accelerated Service per ASTM D-756

END OF SECTION ITEM SPV.0060.11 POLYMER CONCRETE VAULT

Notes: Use this article for Prestressed Precast Concrete Wall Panels. Consult with Central Office Bridge Section.

ITEM SPV.0090.02 VENT TUNNEL EXPANSION JOINT REPAIR

1. DESCRIPTION

This special provision describes removing and disposing of unsound concrete; for furnishing and installing continuous waterstops; and the furnishing, placing and curing concrete for vent tunnel expansion joint repairs.

2. MATERIALS

Furnish materials that are in accordance to the pertinent requirements of section 509 of the Standard Specifications.

Furnish continuous waterstops according to the below:

1. Style Number 726 manufactured by Greenstreak, 3400 Tree Court Industrial Blvd., St. Louis, MO 63122. Phone (800) 325-9504. www.greenstreak.com

2. 6" RCB TPV Waterstop manufactured by JP Specialties, Inc., 551 Birch Street, Lake Elsinore, CA 92530 Phone (888) 836-5778. www.jpsspecialities.com

3. Type No. 6316 manufactured by W.R. Meadows, P.O Box 338, Hampshire, IL. 60140. Phone (800) 342-5976. www.wrmeadows.com

4. Or approved equal.

Furnish cementitious mortar materials according to the below:

1. Eucopatch, Verticoat, or Duraltop Flowable Mortar manufactured by the Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110. Phone (800) 321-7628. www.euclidchemical.com

2. Sikatop 111 Plus, 122 Plus, or 123 Plus manufactured by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071. Phone (800) 933-7452. www.sika.com

3. S66 CI, S88 CI, or SD2 manufactured by BASF Corporation, 100 Campus Drive, Florham Park, NJ 07932. Phone (973) 245-6000. www.basf.us.com

4. Or approved equal.

Furnish epoxy bonding agent materials according to the below:

1. Duralcrete manufactured by the Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110. Phone (800) 321-7628. www.euclidchemical.com

2. Sikadur 32 Hi-Mod LPL manufactured by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071. Phone (800) 933-7452. www.sika.com

Notes: Use this article for Prestressed Precast Concrete Wall Panels. Consult with Central Office Bridge Section.

3. Concresive Liquid LPL manufactured by BASF Corporation, 100 Campus Drive, Florham Park, NJ 07932. Phone (973) 245-6000. www.basf.us.com

4. Or approved equal.

3. CONSTRUCTION

Remove deteriorated concrete in accordance with the requirements of Section 509.3.6 of the Standard Specifications and as shown on the drawings.

Install continuous waterstops in accordance with the manufacturer's requirements and as shown on the drawings.

Place new concrete in accordance with Section 509.3.8 of the Standard Specifications.

It will also be acceptable to use cementitious mortar material for the joint repair. Apply the cementitious mortar by steel trowel to fill the patch area in accordance with the manufacturer's requirements.

Apply an epoxy bonding agent to the overhead concrete surface areas of the joint repair in accordance with the manufacturer's requirements. Provide full surface coverage on the overhead concrete surface area.

4. MEASUREMENT

Vent Tunnel Expansion Joint Repair will be measured by the linear foot acceptably completed.

5. PAYMENT

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.02	Vent Tunnel Expansion Joint Repair	LF

Payment is full compensation for removing and disposing of deteriorated concrete; for furnishing and installing continuous waterstops; and for cleaning reinforcing steel; for forming, furnishing, hauling, placing, curing, and protecting all materials.

END OF SECTION ITEM SPV.0090.02 VENT TUNNEL EXPANSION JOINT REPAIR

ITEM SPV.0090.03 PRECAST CONCRETE BOX CULVERT 6-FT X 6-FT

1. DESCRIPTION

This special provision describes designing, furnishing and installing precast concrete box culverts of the size and length shown on the plans, and in accordance with the requirements of the standard specifications and as hereinafter provided.

2. MATERIALS

Provide materials and fabricate Precast Concrete Box Culvert in accordance with Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers AASHTO Designation M259 or ASTM C1433, except that the concrete mixture shall contain not less than 565 pounds of Portland cement, blended cement or Portland cement plus pozzolanic admixture per cubic yard. Slab thickness, areas of reinforcement, and other details shall be as shown on the plans.

2.1 Design Requirements

It is the responsibility of the contractor to supply a design and supporting documentation as required by this special provision, for review by the department, to show the proposed wall design is in compliance with the design specifications. Four copies of the following shall be submitted to the engineer for review and acceptance no later than 60 days from the date of notification to proceed with the project.

The design/shop plans shall be prepared on reproducible sheets 11 inch x 17 inch, including borders. Each sheet shall have a title block in the lower right corner. The title block shall include the project identification number and structure number. Design calculations and notes shall be on 8 ½ inch x 11 inch sheets, and shall contain the project identification number, name or designation of the wall, date of preparation, initials of designer and checker, and page number at the top of the page. All plans, shop drawings, and calculations shall be signed, sealed and dated by a professional engineer licensed in the State of Wisconsin.

The design shall be in compliance with the *AASHTO LRFD Bridge Design Specifications 5th Edition 2010*, (AASHTO LRFD) with latest interim specifications for Concrete Box Culverts, WisDOT's current *Standard Specifications for Highway and Structure Construction* (Standard Specifications), Chapter 36 of the WisDOT LRFD Bridge Manual and standard engineering design procedures as determined by the Department. Loads, load combinations, load and resistance factors shall be as specified in AASHTO LRFD Section 11 or as given on the plans. The associated resistance factors shall be defined in accordance with Table11.5.6-1 LRFD.

Furnish the department with fabrication drawings of the precast box sections and insert details for approval. Include in the shop drawings the details of the concrete mix design, physical dimensions, methods of manufacture, required concrete compressive strength for the assumptions, design loads, and design calculations. Submit the shop drawings to the department for review at least 30 calendar days prior to fabrication. Do not begin fabrication until written approval of the shop drawings has been received from the Department.

3. CONSTRUCTION

The precast concrete products shall be installed to the lines and grades shown in the contract documents or as other wise specified. These precast products shall be provided with suitable lifting devices by the manufacturer and shall be installed and backfilled per the manufacturers specifications.

4. BOX CULVERT CONDITION REVIEW

The precast concrete box culvert located within the limits of the west retaining wall (R-40-481) is oversized and designed to accommodate the anticipated settlement of the wall. Actual settlement amounts along with potential differential settlement after the wired faced retaining wall is installed may cause conditions of the box culvert that will need to be addressed during the Alternate #3 phase of the project.

A thorough investigation of the concrete box culvert will need to be completed by a qualified engineer along with the contractor and owner. This investigation is to take place no sooner than 30 days prior to the contractor starting work on the Alternate #3 phase of the project but with adequate time for the contractor to complete any of the potential repairs as stated below. The investigation will be examining the box culvert for conditions including but not limited to joint separation, water seepage into the culvert, water seepage through the box culvert into the fill material and structural cracking of the box culvert sections. A determination of placing a natural fill or cast-in-place concrete floor in the culvert will also be made from this investigation. The work under this contract should include the contractor's time commitments to schedule, participate in and assist in developing a plan for any additional repairs needed. This contract will not include anything beyond the initial payment for the box culvert and any additional repairs will be worked out between the contractor and owner a contract amendment.

Potential repair options will vary depending on if any deficiencies are noted and the severity. The placement of a new floor in the culvert will be at the owner's discretion. Since this is for a drainage ditch the culvert would not natural silt in so some additional work to the floor is anticipated. The type and volume of the work is unknown.

Some preliminary repair options are listed below but are not indicative of what will actually be proposed.

- If no problems are found during the investigation.
  - Place a natural bottom or concrete floor to bring inverts back to those designated on the plans.
- For minor joint issues where separation or seepage are noted.
  - Joints will be formed and grouted from the inside. The culvert is oversized to provide the necessary hydraulic section even with interior repairs.
  - Place a natural bottom or concrete floor to bring inverts back to those designated on the plans.
- For major issues such as structural cracking or completely separated joints.
  - Install a 48" diameter HDPE culvert pipe to the inverts designated on the plans.
  - Fill void between pipe and box culvert with grout.

5. MEASUREMENT

The department will measure Precast Concrete Box Culvert 6-FT X 6-FT, completed in accordance with the contract and accepted, in length by the linear foot in place. The box culvert will be measured on the centerline of the box along the flow line.

6. BASIS OF PAYMENT

Measured quantities shall be paid at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.03	Concrete Box Culvert 6-Ft X 6-Ft	LF

Payment is full compensation for all labor, equipment, and materials necessary to design, manufacture, and install precast concrete box elements. Payment is full compensation for furnishing, hauling and placing the box, including joint ties, and mastic; and for furnishing all labor, tools, equipment and incidentals necessary to complete the contract work.

END OF SECTION SPV0090.03 PRECAST CONCRETE BOX CULVERT

PRESTRESSED PRECAST CONCRETE WALL PANEL
ITEM SPV.0165

A. Description

This section describes constructing precast prestressed concrete wall panels with heights as shown on the plans including product design, fabrication, transportation, erection, and other related items.

These specifications provide for prestressing concrete panels by the pretensioning method. In this method, stress the reinforcing tendons initially, then place and cure the concrete and release the stress from the anchorages to the concrete after developing specified concrete strength.

Design shall be in accordance with the AASHTO LRFD Design Specification, 5th Ed., 2010 (AASHTO LRFD). The design life of the precast concrete wall panels and all panel components shall be 75 years.

B. Materials

B.1 General

Furnish materials conforming to the following:

Masonry Anchors	section 502
Coated High Strength Bar Steel Reinforcement	section 505
Pretensioning Reinforcement	section 503
Welded Steel Wire Fabric for Concrete Reinforcement	section 505
Structural Steel and Miscellaneous Metals	section 516
Elastomeric Bearing Pads	section 506

Galvanize, furnish stainless steel materials for all hardware incorporated into the finished structures.

B.2 Concrete

Furnish concrete as specified in section 501 of the standard specifications.

Ensure concrete attains a minimum 28-day compressive strength of 5000 pounds per square inch. Base all tests on 6 inch by 12-inch cylinders, or 4 inch by 8-inch cylinders, provided the engineer develops and approves a correlation factor. Mold concrete cylinders in suitable steel or plastic molds. Cure concrete cylinders according to AASHTO T 23, except cure the cylinders with the member until release strength is obtained, then cure the cylinders according to AASHTO T 23.

The contractor shall make and test the cylinders and make available to the engineer all information relating to the making and testing of cylinders. Notify the engineer immediately if concrete cylinder compressive strengths are less than the required 28-day strength. Keep neatly documented records of all cylinder testing on the day of the test and make them available to the engineer. Provide copies of the tests to the engineer by contract completion.

Furnish prestressed concrete panels cast from air entrained concrete. Use type I, IS, I(SM), IP, II, or III cement. The contractor may replace up to 30 percent of type I, II, or III portland cement with an equal weight of fly ash conforming to 501.2.6 or slag conforming to 501.2.7. Use only one source and replacement rate

for work under a single bid item. Use a department-approved air entraining admixture conforming to 501.2.2 for air entrained concrete. Use only size No. 1 coarse aggregate conforming to 501.2.5.4.

The contractor shall determine proportions for the mix within the following limitations:

Water cement ratio	not greater than 0.45
Cement content, pounds per cubic yard of concrete	610-705
Air content of concrete, percent maximum	3.5-6.0
Slump of mixed concrete, maximum	4 inches

If the mix does not contain a high range water reducer admixture, use a department- approved set retarding admixture as specified in 501.2.3.2 at the recommended rate if the ambient air temperature is 70 degrees F (21 degrees C) or higher. The contractor may use it if the ambient air temperature is less than 70 degrees F (21 degrees C).

The contractor shall not add more admixtures or water after mixing is complete.

Use admixtures that do not have significant chlorides or chlorides added during manufacture.

Use admixtures that are compatible with all ingredients of the concrete mixture.

B.3 Pretensioning Reinforcement

Use high tensile strength, 7-wire strands conforming to ASTM A 416, grade 270.

B.4 Plant Certification

Obtain all precast prestressed concrete wall panels from fabrication plants that comply with the department's plant certification program for prestressed concrete, unless the engineer agrees to accept these items according to the alternate procedures set forth in the department's plant certification program.

B.5 Lifting Devices

The type, number and locations of lifting devices and the method of handling the architectural prestressed precast concrete panels is determined by the fabricator and approved by the engineer. Do not locate lifting devices in the surface of the panel facing toward the road.

B.6 Accessories and Inserts

Materials:

Shims: High-density plastic or galvanized steel, 1/8-inch thick, smooth both sides
Carbon steel plate: ASTM A 283
Welded headed studs: AWS D1.1 – Type B
Bolts, nuts, rods, washers: subsection 506.2
Joint Material: Closed cell 100% virgin chloroprene (neoprene) filler meeting
Inserts: Galvanized with minimum 12 Gage steel conforming to ASTM A1011 SS GR 33 or ASTM A653 GR 33 A. Inserts anchors to have 1 1/2-inch minimum cover.

Zinc coated fabrications: Conform to ASTM 385 for fabricating zinc coated work.

C. Construction

C.1 Design Requirements

Design panels and components to withstand initial handling, transportation, and erection stress limits; dead loads; wind load of 40 pounds per square foot; suction load of 20 pounds per square foot; structural backfill in cavity to 42 inches above finished grade and in front of abutments as shown in the plans; thermal stresses; and other loads specified. In addition to the above loads also design inserts and connection assembles for the loads indicated on the plans and a horizontal force equal to at least 20% of the dead weight of the panel.

Provide a minimum prestress of 250 psi and minimum temperature and shrinkage reinforcement as required by AASHTO LRFD 5.10.8.

C.2 Submittals

Erection drawings shall conform to the contract plans and consist of member piece marks and completely dimensioned size and shape of each member; plans and/or elevations locating and defining all products furnished by manufacturer; sections and details showing connections, cast-in items and their relation to the structure; relationship to adjacent material including footings and copings; joints between members and structure; description of all loose, cast-in and field hardware; field installed anchor location drawings; erection sequences, when required to satisfy stability, and handling requirements; and all dead, live and other applicable loads used in the design.

Production drawings shall conform to the contract plans and consist of elevation view of each member; sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.; handling devices; dimensions and finishes; prestress for strand; concrete strengths; estimated cambers; and methods for storage and transportation.

Submit on request design calculations performed by a registered engineer licensed in the state of Wisconsin experienced in the design of precast prestressed concrete.

Design modifications necessary to meet performance criteria and field coordination. Variations in details or materials shall not adversely affect the appearance, durability, or strength of units. Maintain general design concept without altering profiles and alignment.

Submit on request reports on materials, compressive strength tests on concrete and water absorption tests on units.

The contractor shall submit to the engineer, for placing on file before commencing, one set of the submittals that the contractor has checked. In addition, provide two sets to the district office and one set to the bureau of structures for inspection purposes. Only then may fabrication commence without awaiting the results of any review the engineer may make. The engineer may refuse prints of submittals that are not clear and legible. If the engineer requests, submit one additional copy of submittals for review. After review, the contractor shall furnish as many copies of submittals as required.

The submittals become a part of the contract, provided any differences between sections on production drawings and sections the plans show are made only if the engineer approves and if the substitution is made

at no additional expense to the department.

After initial submittal and review, make no deviation from the production drawings or changes to them without the engineer's further review.

The engineer's review of submittals means only a review of the character and sufficiency of the details and does not relieve the contractor from responsibility in regard to errors or omissions on those drawings.

C.3 Mock-up

After standard samples are accepted for color and texture, fabricate one full size 10-feet wide x 10-feet high minimum panel meeting the design requirements, illustrating shape and patterns, lap joints, joint filler, lifting devices, inserts, and attachment points. Mockup to be standard of quality for precast panel work, when accepted by engineer. Keep mockup in plant for checking purposes.

C.4 Stressing Procedure

Stressing procedure shall be in accordance with 503.3.1. Ensure all the strands of a pretensioned member are free from kinks or twists before starting tensioning operations. Ensure no strand unwinds more than one turn after starting tensioning operations.

Perform transfer of prestress to concrete after the concrete develops the minimum required strength for transfer determined by the test cylinders.

C.5 Placing and Fastening Steel

Placing and fastening steel shall be in accordance with 503.3.1.1. Place all steel units in the position the plans show and hold firmly during concrete placing and setting as specified in 505.3.

Ensure that all prestressing steel is free of dirt, grease, wax, scale, rust, oil, or other foreign material that may prevent bonding between the steel and the concrete.

C.6 Placing Concrete

Handle and place the concrete as specified in section 502 of the standard specifications.

C.7 Tolerances

Cast architectural precast concrete panels to plan dimensions within the following applicable tolerances:

Overall height of panel measured at the face exposed to view ±1/8-inch per 10 ft.
Overall width of panel measured at the face exposed to view ±1/8-inch per 10 ft.
Total thickness ..... ± 1/4-inch
Structural thickness ..... ± 1/4-inch
Variation from square or designated skew ..... ± 1/2-inch
Local smoothness, unconcealed surfaces ..... ± 1/4-inch per 10 ft.
Bowing ± Length/360, to a maximum of 1-inch

Warp (from adjacent corner) ..... ± 1/16-inch per ft.
Location of inserts ..... ±1/2-inch
Tipping and flushness of inserts..... ± 1/4-inch
Position of handling devices..... ± 3-inch
Reinforcing steel:
Where position has structural implications or affects
concrete cover..... ± 1/4-inch
Otherwise ..... ± 1/2-inch
Location of strand:
Perpendicular to panel ..... ± 1/4-inch
Parallel to panel..... ±1-inch
Dimensions of architectural features and rustications…… ±1/4-inch

C.8 Curing

Cure concrete in accordance with section 503.2.2 of the standard specifications.

C.9 Surface Finish

Provide a rubbed surface finish on the exposed surfaces of prestressed concrete panels as specified in 502.3.7.3 before shipping from the plant. Exposed face to match approved mockup panel. Use rigid molds to maintain panels within specified tolerances conforming to shape, lines, and dimensions shown on the production drawings. Construct molds to withstand vibration method selected.

Coat bottom of panels with bitumastic after cutting strands flush. Do not coat top of panels.

C.10 Erection

For R-40-480 and R-40-481, a maximum settlement of approximately 14-inches is anticipated. The maximum settlement will not be fully realized until approximately 18 to 36 months from the time of completion of the “Wall Wire Faced Mechanically Stabilized Earth” item. After 6-months, it is anticipated that approximately half of the settlement will be realized. Due to the relative uniformity of the soils, differential settlement is anticipated to be minimal. To address potential adverse impacts from settlement for R-40-480 and R-40-481, the precast concrete wall panels shall not be erected and placed until a minimum of 12 months has elapsed after completion of the “Wall Wire Faced Mechanically Stabilized Earth” item.

Erect panels without damage to shape or finish. Replace or repair damaged panels.

Place precast concrete wall panels so that their final position is vertical. Ensure that the vertical joint openings between panels are uniform and that decorative patterns between panels are aligned.

When panels require adjustment beyond design or tolerance criteria, discontinue affected work; advise engineer.

Verify structure, footings, anchors blocks, rods, couplers, clevises, and other anchor devices are ready to receive panels. Verify that wall panel footings are placed at the proper horizontal and vertical alignments and are ready to the receive wall panels. Place elastomeric pad and shims behind panels to ensure proper

horizontal alignment. Set panels on elastomeric bearing pads and shims and install base angles at ends of panels. Shim vertical joints to get proper opening. Install and compress neoprene joint filler in the lap joints between panels. Fasten top of panels to deadman anchor block assembles at MSE walls, as shown on the plans.

Touch-up scratched or damaged galvanized surfaces.

C.11 Erection Tolerances

Plan location from wall reference line	± 1/2-inch
Plan location from wall alignment	± 1/2-inch
Top elevation from nominal top elevation	± 1.4-inch
Support elevation from nominal elevation:	
Maximum low	1/2-inch
Maximum high	1/4-inch
Plumb in any 10 ft. of panel height	± 1/4-inch
Maximum offset of matching edges and decorative patterns	± 1/4-inch
Maximum offset of matching faces	± 1/4-inch
Joint width (governs over joint taper)	± 1/4-inch
Joint taper maximum	± 3/8-inch
Joint taper over 10 ft. length	± 1/4-inch
Differential bowing or camber as erected between adjacent members of the same design	± 1/4-inch

C.12 Adjusting

Adjust panels so joint dimensions are within tolerances.

D. Measurement

The department will measure Precast Concrete Wall Panel, as set forth in the contract plans without measurement thereof. Any modifications to the contract quantity caused by corrections or revisions of the original contract plan, which have been approved by the engineer, will be measured by the square foot on a vertical plane between a line at a point below finished grade in front of the panel and a line indicating the top of wall including wall cap or coping as shown on the plans. Unless ordered by the engineer, panel area below or above these lines will not be measured for payment.

E. Payment

The department will pay for measured quantities at the contract panel price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165	Precast Concrete Wall Panel	SF

Payment is full compensation for preparing the design drawings and calculations, production drawings, and coordination; for providing concrete and reinforcement steel for the cast-in-place concrete footings and copings, prestressed precast wall panels, including all concrete, grout, mortar, reinforcement steel, tie bars, bearing pads, shims, masonry anchors, filler, anchor plates, angles, slotted inserts and other embedded metal;

for casting and curing concrete; for jacking and prestressing; and for all handling, hauling and erecting, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work. Parapets, railings, abutment bodies and other items above the wall panel cap or coping will be paid for separately. Deadmen anchor blocks, rods, couplers and clevises will be paid for under the bid item “Wall Wire Faced Mechanically Stabilized Earth.” Excavation will be paid for separately.

END OF SECTION ITEM SPV.0165 PRESTRESSED PRECAST CONCRETE WALL PANEL

ITEM SPV.0165.01 CONCRETE STAINING TUNNEL

1. DESCRIPTION

1.1 Clean and prepare the exposed concrete surfaces and furnish and apply a two coat concrete stain to the exposed concrete surfaces of the structure, as detailed in the plans and as hereinafter provided.

2. MATERIALS

2.1 Concrete Stain
Use concrete stain manufactured for use on exterior concrete surfaces, consisting of a base coat and a pigmented sealer finish coat. Use the following products, or approved equal, as part of the two coat finish system:

Tri-Sheen Concrete Surfacer, Smooth by TK Products
Tri-Sheen Acrylic by TK Products
TK-1450 Natural Look Urethane Anti-Graffiti Primers by TK Products
Safe-Cure & Seal EPX by Chem Masters
H + C Shield Plus by Sherwin-Williams
Or approved equal

3. CONSTRUCTION

3.1 General
Furnish, prepare, apply, cure, and store all materials in accordance to the product manufacturer's specifications for the type and condition of application required.

Match or exceed the stain manufacturer's minimum recommended curing time of the concrete or 28 days, whichever is greater, prior to staining.

3.2 Preparation of Concrete Surfaces
Clean all concrete surfaces that are to be coated to ensure that the surface is free of all laitance, dirt, dust, grease, efflorescence, and any foreign material and that the surface will accept the coating material according to product requirements. As a minimum, clean the surface using a 3000-psi water blast. Hold the nozzle of the water blaster approximately 6 inches from the concrete surface and move it continuously in a sweeping motion. Give special attention to smooth concrete surfaces to produce an acceptable surface texture. Correct any surface problems resulting from the surface preparation methods. Grit blasting of the concrete surface is not allowed.

3.3 Staining Concrete Surfaces
Apply the concrete stain in accordance to the manufacturer's recommendations.

Apply the concrete stain when the temperature of the concrete surface is 45º F or higher, or as given by the manufacturer.

Coordinate the color of the stain with the Owner. Tint the base coat to match the finish coat; the two coats shall be compatible with each other.

Do not begin staining the structure until earthwork operations are completed to a point where this work can begin without receiving damage. Where this work is adjacent to exposed soil or pavement areas, provide temporary covering protection from overspray or splatter.

3.4 Test Areas

Prior to applying stain to the entire concrete surface, a test application shall be performed on a minimum area of 48” x 48” on the existing concrete surface. Do not apply stain to the entire concrete surface until the Owner approves the test application.

3.5 Surfaces to be Coated.

Apply concrete stain to the surfaces in accordance to the plan.

4. MEASUREMENT

The department will measure Concrete Staining in area by the square foot of surface, acceptably prepared and stained.

5. PAYMENT

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.01	Concrete Staining	SF

Payment is full compensation for cleaning and preparing the existing concrete surface; for furnishing and applying the two coat system; for preparing the test area; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

END OF SECTION SPV.0165.01 CONCRETE STAINING TUNNEL

ITEM SPV.517.1010.S CONCRETE STAINING BRIDGES & WALLS

1. DESCRIP[TION

Furnish and apply a two coat concrete stain to the exposed concrete surfaces of structures as detailed in the plans, and as hereinafter provided.

2. MATERIALS

1.1 Mortar

On pertinent surfaces, use mortar for sack rubbing the concrete surfaces as given in section 502.3.7.5 or use of the following products:

Preblended, Packaged Type II Cement: Tri-Mix by TK Products
Thoroseal Pearl Grey by Thoro Products

The mortar shall contain one of the following Acrylic Bonding Admixtures mixed and applied as given by the manufacturer:

Acrylic Bonding Admixture: TK-225 by TK Products
Achro 60 by Thoro Products
Achro Set by Master Builders

1.2 Concrete Stain

Use concrete stain manufactured for use on exterior concrete surfaces, consisting of a base coat and a pigments sealer finish coat. Use the following products, or equal as approved by the department, as part of the two-coat finish system:

Tri-Sheen Concrete Surfacer, smooth by TK Products
Tri-Sheen Acrylic by TK Products
*TK-1450 Urethane Anti-Graffiti Primer by TK Products
TK-5272 Tri-Sheen Pigmented Stain
Safe-Cure & Seal EPX by Chem Masters
H + C Shield Plus Ultra by Sherwin Williams
B-97 Series Concrete Sealer by Sherwin Williams
B-97-200 Series Concrete Stain by Sherwin Williams
(*Natural Look)

3. CONSTRUCTION

Furnish, prepare, apply, cure and store all materials according to product manufacture directions specified for the type and condition of application required.

Match or exceed the stain manufacturer's minimum recommended curing time of the concrete or 28 days, whichever is greater, prior to staining.

3.1 Preparation of Concrete Surfaces

On pertinent surfaces, provide a sack rubbed finish as given in subsection 502.3.7.5 using mortar as indicated above, on concrete surfaces with open voids or honeycombing. Fill all voids larger than ¾" diameter and finish to match surface pattern.

Prior to staining, clean all concrete surfaces to be stained to ensure that the surface is free of all laitance, dirt, dust, grease efflorescence, and any foreign material in order to accept the stain according to product requirements. At a minimum, the cleaning should consist of a 3000 psi water blast. Hold the nozzle of the water blaster approximately 6” from the concrete surface and move it continuously in a sweeping motion. Give special attention to smooth concrete surfaces to produce an acceptable surface texture. Correct any surface problems resulting from the surface preparation methods. Grit blasting of the concrete surface is not allowed.

3.2 Staining Concrete Surfaces

Apply the stain in strict conformance with product manufacture requirements.

Apply the concrete stain when the temperature of the concrete surface is 45 degrees F or higher, or as given by the manufacturer.

The final color of the concrete following application of the stain system shall match the Sherwin Williams Color system. Sherwin Williams Color designation is for color only; all colors shall be a flat (lusterless) finish.

Base Color	Whole Wheat – SW6121, FN122

Do not begin the staining the structure until adjacent operations are completed to a point where this work can begin without receiving damage. Where this work is adjacent to exposed soil or pavement areas, provide temporary covering protection from overspray or splatter.

3.3 Test Areas

Prior to applying the stain to the structure, test applications shall be required on sample panels measuring 48” x 48”, and constructed to demonstrate workmanship in the use of the form liner reveals, protrusions and lettering on the structures. Match or exceed the stain manufacturer’s minimum recommended curing time of the concrete or 28 days, which ever is greater, prior to staining. Prepare the concrete surfaces of the sample panels and apply stain using the same materials and in the same manner as proposed for the structure, including staining of the joints between stones produced by the form liner if applicable. Do not apply the stain to the structure until the department approves the test panels.

3.4 Surfaces to be Coated

Apply the concrete stain to the surfaces as shown on the plan.

3. MEASUREMENT

The department will measure Staining Concrete by the square foot acceptably completed.

4. PAYMENT

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.500	Staining Concrete	SF

Payment is full compensation for furnishing and applying the two-coat system; for preparing the concrete surface and sample panels; and for furnishing all labor, equipment, tools and incidentals necessary to complete the work.

END OF SECTION ITEM SPV.517.1010.S CONCRETE STAINING BRIDGES & WALLS

SPECIAL PROVISIONS
WALL WIRE FACED MECHANICALLY STABILIZED EARTH LRFD, ITEM SPV.532.0700.S

A. Description

This special provision describes designing, furnishing materials and erecting a permanent earth retention system in accordance to the lines, dimension, elevations and details as shown on the plans and provided in the contract. The design life of the wall and all wall components shall be 75 years minimum.

B. Materials

B.1 Proprietary Wire Faced Mechanically Stabilized Earth Wall Systems

The supplied wall system must be from the department's approved list of Wire Faced Mechanically Stabilized Earth Wall systems (Wire Faced MSE Walls).

Proprietary wall systems may be used for this work, but must conform to the requirements of this specification and be pre-approved for use by the department's Bureau of Structures, Structures Design Section. The department maintains a list of pre-approved Wire Faced Mechanically Stabilized Earth (Wire Faced MSE) Wall systems. The name of the pre-approved proprietary wall system selected shall be furnished to the engineer within 25 days after the award of contract.

To receive pre-approval, the retaining wall system must comply with all pertinent requirements of this provision. Applications for pre-approval may be submitted at any time. Applications must be prepared in accordance to the requirements of Chapter 14 of the department's current LRFD Bridge Manual. Information and assistance with the pre-approval process can be obtained by contacting the Structures Design Section in Room 601 of the Hill Farms State Transportation Building in Madison or by calling (608) 266-8494.

B.2 Design Requirements

It is the responsibility of the contractor to supply a design and supporting documentation as required by this special provision for review by the department to show the proposed wall design is in compliance with the design specifications. Four copies of the following shall be submitted to the engineer for review and acceptance no later than 60 days from the date of notification to proceed with the project.

The design/shop plans shall be prepared on reproducible sheets 11 inch x 17 inch, including borders. Each sheet shall have a title block in the lower right corner. The title block shall include the project identification number and structure number. Design calculations and notes shall be on 8 ½ inch x 11 inch sheets, and shall contain the project identification number, name or designation of the wall, date of preparation, initials of designer and checker, and page number at the top of the page. All plans, shop drawings, and calculations shall be signed, sealed and dated by a professional engineer licensed in the State of Wisconsin.

The design of the Wire Faced MSE Walls shall be in compliance with the *AASHTO LRFD Bridge Design Specifications 5th Edition 2010*, (AASHTO LRFD) with latest interim specifications for Mechanically Stabilized Earth Walls, WisDOT's current *Standard Specifications for Highway and Structure Construction* (Standard Specifications), Chapter 14 of the WisDOT LRFD Bridge Manual and standard engineering design procedures as determined by the Department. Loads, load combinations, load and resistance factors shall be as specified in AASHTO LRFD Section 11. The associated resistance factors shall be defined in accordance with Table 11.5.6-1 LRFD.

Design and construct the walls in accordance to the lines, grades, heights and dimensions shown on the plans, as herein specified, and as directed by the Department. If the wall is installed in front of a bridge abutment or wing, it shall also be designed to resist the applied abutment/bridge lateral forces specified on the contract plans.

Walls parallel to supporting highway traffic shall be designed for the effects of highway surcharge loading equivalent of 2 feet soil surcharge weight or 240 psf. The design shall also consider the traffic barrier impact where applicable. Walls that do not carry highway traffic shall be designed for a live load surcharge of 100 psf in accordance with Chapter 14 of the WisDOT LRFD Bridge Manual or as stated on the plans.

A maximum value of the angle of internal friction of the wall backfill material used for design shall be assumed to be 30 degrees without a certified report of tests. If a certified report of tests yields an angle of internal friction greater than 30 degrees, the larger test value may be used for design, up to a maximum value of 36 degrees.

An external stability check at critical wall stations showing Capacity Demand Ratios (CDR) for sliding, eccentricity, and bearing checks is performed by the department or its consultant, and is provided in the wall plans.

The design of the Wire Faced MSE Walls by the Contractor shall consider the internal and compound stability of the wall mass in accordance with AASHTO LRFD 11.10.6. The internal stability shall include soil reinforcement pullout, soil reinforcement rupture, and panel-reinforcement connection failure at each soil reinforcement level. The design shall be performed using the Simplified Method or Coherent Gravity Method. Calculations for factored stresses and resistances shall be based upon assumed conditions at the end of the design life. Compound stability shall be computed for the applicable strength limits.

The minimum embedment of the Wire Faced MSE wall shall be 1 foot 6 inches, or as given on the contract plan. Frost depth shall not be considered. The wall facings shall be designed in accordance with AASHTO 11.10.2.3. A fine metallic screen and a geotextile filter fabric shall be used at the front face of the wall to retain the fines of the soil mass.

The nominal long term design strength to be used in steel reinforcement and connector design shall consider the corrosion losses and based upon conditions at the end of the design life. The minimum length of soil reinforcement measured from the back face of the wall shall be equal to 0.7 of the wall height or as shown on the plan. In no case shall this length be less than 8 feet. The soil reinforcement shall be the same length from the bottom to the top of each wall section. All soil reinforcement layers shall be connected to facings. The soil reinforcement shall extend 3 feet beyond the theoretical failure plane in all cases. The maximum vertical spacing of soil reinforcement layers shall be 24 inches. The uppermost layer of the reinforcement shall be located between 6” and 12” below the bottom of an overlying slab, footing or top of the wall. The upper layers of the soil reinforcement shall also be checked to verify that they have sufficient tensile resistance against traffic barrier impact where applicable.

Soil reinforcement shall be fabricated or designed to avoid piling, drainage structures or other obstacles in the fill without field modifications. Cutting or altering of the basic structural section of either the strip or grid at the site is prohibited unless approved by the Structures Design Section. A minimum clearance of 3” shall be maintained between any obstruction and reinforcement unless otherwise approved. Splicing steel reinforcement is not allowed unless approved by the Structures Design Section.

Submit the following to the engineer for review: complete design calculations, explanatory notes, supporting materials, specifications, and detailed plans and shop drawings for the proposed wall system. Sample

analyses and hand output shall be submitted to verify the output by the software. The design calculations and notes shall clearly indicate the Capacity to Demand Ratios (CDR) for all internal stabilities as defined in AASHTO LRFD.

The wall submittal package shall be submitted electronically to the project engineer and the Structures Design Section. Submit all required information no later than 30 days prior to beginning construction of the wall. The detailed plans and shop drawings shall include all details, dimensions, quantities and cross-sections necessary to construct the walls.

The design of the MSE Wire Faced Wall shall include design of dead man anchor blocks, rods, couplers, and clevises that connect the precast concrete wall panels. Design these items to resist a minimum horizontal force as defined in section C.1 of the “Precast Concrete Wall Panel” specification. Design these items with sufficient capacity to fully perform if one connection per panel fails.

The design of the MSE Wire Faced Wall shall include design of soil reinforcement and anchorage to abutments within the reinforced zone, dead man anchor blocks, rods, couplers, and clevises that connect to precast concrete wall panels. Design these items to resist a minimum horizontal force as defined in section C.1 of the “Precast Concrete Wall Panel” specification.

B.3 Wall System Components

Materials furnished for wall system components under this contract shall conform to the requirements of this specification. All certifications related to material and components of the wall systems specified in this subsection shall be submitted to the engineer.

B.3.1 Steel Components

All steel components of permanent Wire-Faced MSE walls shall be galvanized in accordance to ASTM A-123. Provide steel reinforcement that meet the following requirements:

- Welded Wire Fabric Soil Reinforcement

Provide shop fabricated welded wire reinforcement from cold drawn steel wire that has a yield stress of 65,000 psi and conforming to the minimum requirements of ASTM A-82 and be welded into the finished configuration in accordance to ASTM A-185. A minimum galvanization coating of 2 oz/ft^2 or 3.4 mils thickness is required. Replace welded wire fabric that has been damaged during handling, placing or backfilling at the direction of the engineer, at no expense to the department.

- Steel Reinforcing Strips and Tie Strips

As an alternate to Welded Wire Reinforcing mesh, provide Steel Reinforcing strips or ladder Reinforcing strips or equal, hot-rolled from bars, to the required shape and dimensions meeting the requirements of ASTM A-572 Grade 65 minimum and galvanized to a minimum thickness of 3.4 mils. Tie strips shall be shop fabricated of hot-rolled steel meeting the requirements of ASTM A-1011 Grade 50.

- Welded Wire Fabric Facing Panels

Provide welded wire fabric that is used to fabricate the facings of the wire-Faced wall that has a yield stress of 65,000 psi. All steel shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A-82 and be welded into the finished configuration in accordance to ASTM A-185. Replace welded wire fabric that has been damaged during handling, placing or backfilling at the direction of the engineer, at no expense to the department.

- Fasteners

Galvanized high strength bolts meeting the requirements of AASHTO M164 or equivalent.

- Connector Pins and Mat Bars

Connector pins and mat bars fabricated from cold drawn steel wire meeting the requirements of ASTM A-82 and galvanized to according to ASTM 123 to a minimum thickness of 3.4 mils.

- Metallic Screen

Provide a stainless steel or galvanized steel metallic screen per AASHTO M-111. The metallic screen should have an approximate opening of ¼" and be made of 0.025" (minimum) gauge wire.

B.3.2 Geotextile Filter Fabric

Geotextile filter fabric shall be used behind the metallic screen. Use geotextile as recommended by the wall manufacturer. If none is recommended, use Type DF (schedule B) as shown in Section 645 of the WisDOT Standard Specifications or as specified on the contract plans.

B.3.3 Backfill

Furnish and place backfill for Wire- Faced MSE wall as shown on the plans and as herein provided. Provide and use material that consists of natural sand or a mixture of sand with gravel, crushed gravel or crushed stone. It shall not contain foundry sand, bottom ash, blast furnace slag, crushed concrete, crushed/milled asphaltic concrete or other potentially corrosive material.

Provide material that conforms to the following gradation requirements.

Sieve Size	**% by Weight Passing**
1 inch	100
No. 40	0-60
No. 200	0-15

The material shall have a liquid limit not greater than 25, as per AASHTO T89, and a plasticity index not greater than 6, as per AASHTO T90.

In addition, backfill material shall meet the following requirements.

Test	**Method**	**Value**
pH	AASHTO T-289	5 – 10.0
Sulfate content	AASHTO T-290	200 ppm max.
Chloride content	AASHTO T-291	100 ppm max.
Electrical Resistivity	AASHTO T-288	3000 ohm/cm min.
Angle of Internal Friction	AASHTO T-236	30 degrees min.
Organic Content	AASHTO T-267	1.0% max.

Prior to placement of the backfill, obtain and furnish to the engineer a current report of test results that the backfill material complies with the requirements of this specification. Tests will be performed by a certified independent laboratory. When backfill characteristics and/or sources change, a certified report of tests will be provided for the new backfill material.

B.3.4 Deadmen and Wall Panel Connection Components

Furnish materials conforming to the following:

Concrete Masonry…….section 501
Structural Steel and Miscellaneous Metals……..section 506

Galvanize, or furnish stainless steel materials for all hardware incorporated into the finished structures.

B.4 Settlement Monitoring System

Furnish materials conforming to the following:

2’ x 2’ Heavy Gauge Steel Plate…….section 506
Threaded Pipe Socket for ½” Diameter Pipe……..section 506
½” Diameter Galvanized Steel Pipe……..section 506
¾” PVC Piping, Schedule 40……UL 651

C. Construction

C.1 Methods

All excavation and preparation of the foundation for the Wire-Faced Mechanically Stabilized Earth wall shall be in accordance to section 206 of the standard specifications. The volume of excavation covered is limited to the width of the reinforced mass and to the depth of the bottom of the wall unless shown or noted otherwise on the plan. At the end of each working day, provide good temporary drainage such that the backfill shall not become contaminated with run-off soil or water if it is should rain. Do not stockpile or store any materials or large equipment within 10 feet of the back of the wall.
Stagger vertical joints in the welded wire facing.

Compact all backfill behind the wall as specified in 207.3.6 of the standard specifications. Compaction of backfill within 3 feet of the back face of the wall should be accomplished using lightweight compaction devices. Use of heavy compaction equipment or vehicles should be avoided within 3 feet of the wall face. Compact the backfill to 95.0% of maximum density as determined by AASHTO T-99, Method C.

Perform compaction testing on the backfill. When performing nuclear testing, use a nuclear gauge from the department’s approved list, ensure that the operator is a HTCP certified Nuclear Density Technician I, and conform to CMM 8.15 for testing and gauge monitoring methods. Conduct testing at a minimum frequency of 1 test per 2 feet of vertical wall height, per 200 feet length of wall, or major portion thereof. A minimum of one test for every 2 feet of vertical wall height is required. Test sites will be selected using ASTM Method D3665. Deliver documentation of all compaction testing results to the engineer at the time of testing. The cost of compaction testing shall be considered incidental to the cost of the wall.

Erect welded wire facing and other associated elements according to the wall manufacturer's construction guide. Place and compact the MSE backfill to the level of the next higher layer of MSE reinforcement before placing the MSE reinforcement or connecting it to the wall facing. Place remaining courses in vertical or battered positions as shown on the contract plans.

The MSE reinforcement shall lay horizontally on top of the most recently placed and compacted layer of MSE backfill. Bending of MSE reinforcement that result in a kink in the reinforcement shall not be allowed. If skewing of the reinforcement is required due to obstruction in the reinforced fill, the maximum skew angle shall not exceed 15 degrees from the normal position unless a greater skew angle is shown on the wall shop drawings. The adequacy of the skewed reinforcement in such a case shall be addressed by supporting calculations.

C2. Tolerances

- **The overall vertical tolerance of the wall and the horizontal alignment tolerance shall not exceed 2 inches per 10 feet for permanent installations.**

- **Where a cast-in-place facing or a precast concrete panel facing is installed, the overall vertical tolerance shall not exceed ±1 inch or as shown on the contract plans.**

- **For battered wire facing, the final deviation from the design batter shall be within ±3/4 inch for each 10 feet of battered wall height.**

- **The offset limit between consecutive rows of facing shall not exceed one inch.**

C.3 Geotechnical Information

Geotechnical data to be used in the design of the wall is given on the wall plan. After completing wall excavation of the entire reinforced soil zone, notify the department and allow the Regional Soils Engineer two working days to review the foundation.

C.4 Settlement Monitoring System

C.4.1 Installation

The contractor is to install one (1) 2' x 2' steel plate with pipe socket welded to center of plate in sets starting at 5' behind the proposed abutments with additional sets to be placed at 100-ft intervals from the initial set. Each set will consist of three (3) plates total with one plate located at the embankment centerline and the others at 5' from the each outside edge of the embankment. The ½" diameter steel pipe will be threaded into the socket and the ¾" PVC pipe will be placed outside the steel pipe to act as a sleeve and allow free movement of the steel pipe. Additional sections of steel and PVC pipe should be added as the embankment is constructed. The exposed portion of the steel pipe should be marked for visibility.

Compaction of all fill material within a minimum 3' diameter of the steel pipe shall be accomplished by hand equipment. Lift thicknesses may need to be reduced within this area to facilitate proper compaction. Compaction density requirements are the same near the settlement monitoring system as the bulk of the embankment material.

C.4.2 Monitoring

This work is to be done by others.

The horizontal and vertical location of the steel piping at each settlement monitoring point should be determined on a daily basis during construction of the embankment. Upon completion of the embankment construction the measurements shall be on a weekly basis for one month, on a bi-weekly basis for one month, monthly for two months and every three months thereafter.

D. Measurement

The department will measure Wire Faced Mechanically Stabilized Earth Wall by the square foot acceptably completed, measured as the vertical area within the pay limits the contract plans show. No other measurement of quantities shall be made in the field. Unless the Engineer directs in writing, a change to the limits indicated on the contract plan, wall area constructed above or below these limits will not be measured for payment.

E. Payment

The department will pay for accepted measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.XX	Wall Wire Faced Mechanically Stabilized Earth LRFD	SF

Payment is full compensation for supplying a design and shop drawings; preparing the site, including all necessary excavation and disposal of materials; supplying all necessary wall components to produce a functional system including dead man anchor system and components to connect to precast wall panels; constructing the retaining system, including drainage system; providing backfill, backfilling, compacting, and performing compaction testing; provide for the installation of the dead man anchors, soil reinforcement behind bridge abutment and for furnishing all tools, labor, equipment, and incidentals necessary to complete the contract work and for furnishing and placing settlement monitoring system. Parapets, railings, abutment bodies and other items above the wall cap or coping will be paid for separately. Vehicle barrier and its support will be paid separately.

Any required topsoil, fertilizer, seeding or sodding and mulch will be paid for at the contract unit price of topsoil, fertilizer, seeding or sodding and mulch, respectively.
532-035 (20120630)

END OF SECTION SPV.532.0700.S WALL WIRE FACED MECHANICALLY STABILIZED EARTH

ITEM SPV.550.2102.S PILING STEEL HP 12X53

Delete standard spec 508, 510 and 511 and replace with the following:

550.1 DESCRIPTION

This section describes furnishing, driving, cutting off, and finishing piles of the types and dimensions shown on the plans; making submittals for driving system; splicing if necessary; pre-boring if required; redriving if required; painting if required; furnishing and installing pile end plates or pile shoes, if required; furnishing and placing steel reinforcement in piles if required, and furnishing, placing, curing, and protecting concrete in cast in place concrete piles.

This section also describes methods used to determine the required driving resistance, as shown on the plans.

550.2 MATERIALS

550.2.1 Steel Piling

Unless otherwise stated in this specification or directed by the engineer, submit at or before delivery of the steel piling the certified report of test or analysis as specified for structural steel mill inspection and testing in 506.3.21.

550.2.1.1 Steel HP Sections

Furnish material that conforms to the requirements for structural steel in 506.2.2 utilizing ASTM A 572 grade 50 steel unless the plans show otherwise.

550.2.1.2 Steel Pipe Sections

Furnish material that conforms to the requirements for structural steel in 506.2.2 utilizing ASTM A 252, grade 2, or an engineer approved alternate.

Furnish steel pipe with an outside diameter of no less than 7 ¾ inches and a wall thickness of no less than 3/8 inch.

550.2.1.3 Steel Oil Field Pipe Sections

Furnish material that conforms to ASTM A252, Grade 3 with a maximum tensile strength of 85,000 psi. If replacing HP piling, provide pipe with a cross section that equals or exceeds 97 percent of the area of the HP piling originally specified. The pipe shall have a minimum outside diameter of 7 ¾-inches and a minimum wall thickness of 3/8-inch. Ensure that each pipe on each load delivered to the project conforms to the bill of lading and is marked to uniquely identify the load. Make the marking durable and legible.

At or before delivery, furnish certification of the pipe's chemical composition that was used to determine its carbon equivalency (CE) from the equation shown below. Ensure that CE does not exceed 0.50.

$$CE = C+1/6(Mn+Si+Cr+Mo+V)+1/15(Ni+Cu)$$

Use pipe delivered in a magnetized condition for non-welded applications only.

550.2.2 Cast in Place Concrete Piles

550.2.2.1 General

Furnish materials conforming to the following:

Concrete	Section 501	Grade A, A-FA, A-S, A-T, A-IS, A-IP
Steel Reinforcement	Section 505	

Unless the contract requires otherwise, at the time of pile shell delivery, submit to the engineer a manufacturer's certified report of test or analysis showing the pile shells conform to the above requirements.

Furnish shells bearing markings that identify them with the applicable test report. In the absence of this identification, certify that the delivered shells are from the same lot the test report represents.

Fill all cast-in-place concrete pile shells with concrete. Acceptance of concrete placed for this item will be based on a certificate of compliance. Submit the certification of compliance at least 3 business days before placing concrete.

550.2.2.2 Cylindrical Steel Pile Shells

Furnish material that conforms to the requirements of ASTM A252, Grade 2, or an engineer approved alternate.

Furnish cylindrical shells that are either straight seam welded, spiral weld, or seamless tube type.

Furnish steel shells with a minimum nominal wall thickness of 0.219 inches unless otherwise indicated by the plans or special provisions.

Furnish end plates conforming to the requirements for structural steel in 506.2.2.2 with a minimum thickness of ¾ inch and an outside diameter that does not exceed the pile by more than ¾ inch unless otherwise indicated on the plans.

550.2.3 Pre-Cast Concrete Piling

Furnish pre-cast concrete piles conforming to the dimensions and details shown in the plans.

Furnish materials for precast concrete piles in accordance to the requirements of 503.2 with the following modifications.

1. Use air-entrained concrete for all piles unless the plans or special provisions require non-air entrained concrete.
2. Furnish concrete with a minimum 28-day compressive strength of 6000 psi unless the plans or special provisions require greater strength.

Construct precast concrete piles in accordance to the requirements of 503.3.1 and 503.3.2 with the following modifications.

1. The tolerances stated in 503.3.2.1.1 are waived.
2. Cast piles to the dimensions shown on the plans with these tolerances.

Cross Sectional Dimensions	1/8 inch
Chamfers, miters, bevels, radii	1/8 inch
Pre-stressing steel location	1/8 inch
Length	1/8 inch per 10 feet of length, not to exceed ½ inch
Variation from true plane – long axis	1/8 inch per 10 feet of length, not to exceed ½ inch

Handle and store piles so that damage from excessive bending stresses or impacts does not occur. Lift piles by using a suitable bridge or slings attached at the lift points shown on the plans. Construct slings of a fabric material or braided wire rope constructed of six or more wire ropes that will not mar the surface or corners of the pile. Do not use chains to handle piles. During transport, either support piles at the lift points or provide full support over at least 80 percent of the full length. Store piles on blocks or skids made of wood or other suitable materials. At a minimum, position supports at the pickup points.

550.2.4 Pile Points

Select and furnish commercially manufactured pile points from the department's approved products list of the type and dimensions shown on the plans.

550.3 CONSTRUCTION

550.3.1 General

Use only one type of pile throughout the structure unless shown on the plans or the engineer allows otherwise.

Unless the plans state otherwise, steel pipe sections or steel oil field pipe sections may be substituted for steel HP sections. Use pipe sections with a steel area of at least 97 percent of the steel area of steel HP section that it replaces.

Coordinate all pile driving operations so that no damage or displacement occurs to concrete in any substructure unit because of pile driving operations.

Do not drive piles for any substructure unit until the excavation for that unit is complete. Remove any material within the limits of the footing forced up by pile driving operations to the correct elevation before placing concrete. All necessary removal of material will be at no expense to the department.

Drive all piles with a variation of not more than ¼ inch per foot from the vertical or from the batter shown on the plans. Drive piles for trestle bents so that no pile is more than 3 inches from the position shown on the plans after driving and that placing the cap on the piles does not adversely affect the resistance of the piles. Ensure that all other piles are within 6 inches of the position the plans show after driving.

Do not damage piles by applying excessive force to correct misalignment.

Drive piles continuously to the required driving resistance shown in the plans, and if specified in the plans, the required minimum tip elevation, unless the engineer approves discontinuous driving. The engineer may review discontinuous driving at the end of initial driving. For the purposes of this section, the department defines discontinuous driving as an interruption to the driving of a pile lasting 3 hours or more.

Drive piles in pile groups starting at the center of the group and proceeding outward in both directions, or start at the outside row and proceed progressively across the group.

Remove and replace all piles that are in the engineer's judgment unsuitable for use due to improper positioning, misalignment, or damage such as bends, breaks, kinks, deformation, cracking, or spalling resulting from internal defects, improper handling, or improper driving. Other corrective measures may be used if approved by the engineer. All corrective measures shall be at no expense to the department.

Conform to the requirements of 550.3.4 for all welds and welding necessary for pile splices.

Re-drive all piles pushed up 0.25 inch or more by the driving of adjacent piles or by any other cause. Re-drive piles as directed by the engineer using approved equipment and methods.

Do not drive pre-cast concrete piles until the concrete develops the required 28 day compressive strength and a minimum cure time of 7 days has elapsed.

550.3.2 Ordering Piles

The estimated lengths of piling shown on the plans are approximate only and were determined for design and estimating purposes from soil borings taken at the site.

If test piles are included in the contract, furnish test piles of the length shown on the plans. Order production piles based on the driving results of the test piles.

Furnish piling of sufficient length to obtain the required driving resistance shown on the plans for each pile.

550.3.3 Fabrication and Delivery

550.3.3.1 Steel Piles
Except for piling made from cutoffs with the engineer's permission, furnish steel HP, steel pipe, and steel oil field pipe sections up to and including 20 feet in length with no splices. Furnish piling from 20 to 50 feet in length with no more than two shop or field splices and piling more than 50 feet in length with no more than four shop or field splices.

Do not fabricate piles from cutoffs unless approved by the engineer.

Use pile segments at least 5 feet in length for the manufacture of all piles.

550.3.3.2 Steel Pile Shells for Cast in Place Concrete Piles
Except for piling made from cutoffs with the engineer's permission, furnish steel pile shells for cast In place concrete piles up to 50 feet in length with not more than three shop or field splices. Furnish steel pile shells over 50 feet in length with not more than four shop or field splices.

Do not fabricate piles from cutoffs unless approved by the engineer.

Use pile segments at least 5 feet in length for the manufacture of all piles.

550.3.3.3 Pre-cast Concrete Piles
Furnish pre-cast concrete piles in lengths of 60 feet or less in one continuous length without splices. For piles in excess of 60 feet in length but not more than 120 feet, furnish piles with no more than one splice. For piles greater than 120 feet in length, conform to the splicing requirements shown in the plans or contained in the special provisions.

550.3.4 Splices
Except for pre-cast concrete piling splices, weld splices as the plans show and conforming to the AWS D1.1/D1.1M Structural Welding Code – Steel. Use shielded metal arc welding (SMAW) for welds on portions of piles that will be above grade in service. Certify the quality of field welds as follows:

1. Designate who will visually inspect the contractor's welding. Ensure that the designated inspector is an AWS certified welding inspector (CWI) or a department-approved individual competent to perform inspections.
2. Have the designated inspector evaluate the field welding at suitable intervals.
3. Have the designated inspector complete department form DT2320 for each structure and submit the form to the engineer for inclusion in the permanent project record.

Mechanical splices are not allowed.

550.3.4.1 Steel HP Piling and Steel Pipe Piling
All splices shall develop the full strength of the pile in compression, tension, and bending.

Conform to all details for splices as shown in the plans. If splice details are not shown, submit proposed splice details for the engineer's approval.

550.3.4.2 Steel Oil Field Pipe Piling
All splices shall develop the full strength of the pile in compression, tension, and bending.

Position backup rings flush with the joint and place according to AWS D1.1/D1.1M Structural Welding Code – Steel. Ensure that the rings allow the joint to contract freely as the weld cools. Make tack welds the smallest size necessary to hold the pipe ends in alignment for welding.

For materials not listed in table 3.1 of the AWS D1.1 code, preheat for a distance of 5 inches on both sides of the weld. Preheat pipe with a CE less than 0.35 to 100° F. Preheat pipe with a CE between 0.35 and 0.45 inclusive to 250° F and preheat pipe with a CE between 0.45 and 0.50 inclusive to 400° F.

Protect the pipe ends from high winds and precipitation during the welding process by housing or sheltering.

Threaded or mechanical splices that transfer full pile strength may be used if approved by the engineer.

550.3.4.3 Steel Piling Shells for Cast in Place Concrete Piles
Use backup rings for all field splices.

Conform to splice details as shown in the plans.

Make all splices watertight.

All splices shall develop the full strength of the pile in compression, tension, and bending.

550.3.4.4 Pre-Cast Concrete Piling
Unless otherwise shown in the plans or special provisions, all splices shall develop the full strength of the pile in compression, tension, and bending.

Make splices by the cement dowel method. Conform to details shown in the plans.

Mechanical splices may be used only if allowed by the plans or special provisions.

550.3.5 Equipment

550.3.5.1 Hammers
Drive piles with diesel, air, steam, or hydraulic hammers. Vibratory hammers may be used with the approval of the engineer. Piling installed with a vibratory hammer must be re-struck with an impact hammer to determine final penetration resistance necessary to obtain the required driving resistance.

Furnish single acting diesel hammers equipped with a suitable device or mechanism to permit the engineer to visually determine accurate hammer stroke at all times during pile driving operations. Provide the engineer with a chart from the hammer manufacturer that equates stroke and equivalent energy for the hammer furnished.

Furnish double acting diesel hammers equipped with a bounce chamber pressure gauge in good working order mounted near ground level so as to be easily read by the engineer. Furnish the engineer with a certified chart calibrated to actual hammer performance equating bounce chamber pressure to either equivalent energy or stroke for the hammer furnished. Furnish an initial calibration no more than 90 days old. Re calibrate the hammer every 90 calendar days.

Furnish air or steam hammers with a plant and equipment that can maintain the manufacturer's specified volume and pressure under working conditions. Equip the plant and equipment with accurate pressure gauges that are easily accessible to the engineer. The weight of the striking parts of the air and steam hammers shall not be less than the weight of the helmet and pile being driven, but in no case shall the striking parts weigh less than 2750 lb.

Furnish hydraulic hammers with power plants that can maintain the manufacturer's specified volume and pressure under working conditions. Equip the power plant and equipment with accurate pressure gauges that are easily accessible to the engineer.

550.3.5.2 Drive System Components and Accessories

550.3.5.2.1 Hammer Cushions

For impact driving systems designed for use with a hammer cushion, furnish a suitable thickness of hammer cushion material to prevent damage to the hammer or pile and ensure uniform driving behavior. Furnish hammer cushions made of durable manufactured materials that conform to the hammer manufacturer's guidelines and requirements. Do not use wood, wire rope, and asbestos hammer cushions. Place a striker plate as recommended by the hammer manufacturer on the hammer cushion to ensure uniform compression of the cushion material. Remove the hammer cushion from the helmet for inspection in the presence of the engineer at the beginning of pile driving on the project and after each 100 hours of driving. Replace the hammer cushion before resuming pile driving if the thickness of the hammer cushion has been reduced by more than 25% of its original thickness.

550.3.5.2.2 Helmets

Furnish an adequate helmet to distribute hammer blows to the pile head. The helmet shall be guided by the leads and shall not be free swinging. During driving, maintain the helmet in axial alignment with the hammer and the pile so that torsional forces are not transferred to the pile.

550.3.5.2.3 Pile Cushions

Furnish a pile cushion made of plywood, hardwood, or a composite plywood/hardwood material to protect the head of pre-cast concrete piles. The minimum pile cushion thickness placed on the pile head prior to driving shall not be less than 4 inches. Use a new pile cushion for each pile. Stop driving and replace the pile cushion if it is compressed more than one-half the original thickness or if it begins to burn. Use pile cushions with dimensions that match those of the top of the pile. Requests to use cushions manufactured from materials other than wood may be submitted for the engineer's review and approval.

550.3.5.2.4 Leads

Furnish and use leads with all pile hammers. Leads may be either fixed or swinging type. Use leads that give the hammer freedom of movement while maintaining alignment of the hammer and pile to ensure concentric impact for each hammer blow.

Rig swinging leads so that the line of travel of the hammer maintains alignment with the axis of the pile.

Provide braces or other support to maintain required alignment during driving. Equip swinging leads with a pile gate at the bottom of the leads.

Unless driving piles through water, use leads of sufficient length such that a follower is not required.

550.3.5.2.5 Followers
Use followers only if driving piles through water and only with the engineer's permission. When permitted, use followers of such material and dimensions to permit driving of the pile to the required depth or elevation.

550.3.5.2.6 Water Jets
Water jet use is restricted to end bearing piling and may be used only if allowed in the contract or approved by the engineer.

Ensure a sufficient number of jets and a sufficient water volume and pressure at the jet nozzles to freely erode the material next to the pile without affecting the lateral stability of the completed pile.

Ensure a plant capacity capable of operating two ¾ inch jet nozzles simultaneously with at least 100-psi pressure at each nozzle.

550.3.6 Pile Driving Equipment Acceptance

550.3.6.1 General
Prior to pile driving, obtain acceptance from the engineer for all pile driving equipment furnished. The engineer will determine if the proposed pile driving equipment can, with reasonable effort, drive the piles to the required driving resistance and, if required, the minimum tip elevation.

Submit completed Form DT3550 to the engineer at least 30 days prior to the start of pile driving. Form DT3550 can be obtained at the following website:
http://roadwaystandards.dot.wi.gov/standards/

Use only the submitted pile driving system during pile driving operations. Submit Form DT3550 to the engineer for any proposed changes to the submitted pile driving system.

550.3.6.2 Acceptance Criteria
Furnish pile driving systems that will drive the pile to the required driving resistance with a minimum blow count of 30 blows/foot and have a minimum rated hammer energy of 12,500 ft-lbs.

The engineer may order removed from service any pile driving system component(s) that may cause insufficient transfer of energy or excessive damage to the pile. The pile driving system component(s) may not be returned to service until repaired/adjusted to the satisfaction of the engineer. Obtain approval from the engineer for any changes to the pile driving system in accordance to the requirements of this section.

550.3.7 Pile Driving

550.3.7.1 General
Drive all piles with the submitted pile driving system to the required driving resistance. The engineer will determine the required penetration resistance by the methods and equations in 550.3.7.2. In addition, if a minimum tip elevation is shown on the plans, drive the piles to, or beyond, that elevation.

Drive all piles to meet the required alignment and location tolerances. The engineer will evaluate all piles that do not meet these requirements to determine if the piles are unacceptable or if corrective measures may be considered. If necessary, propose corrective measures for the engineer's review and approval. Complete all corrective measures approved by the engineer at no expense to the department. The engineer may order removal of any pile determined to be unacceptable.

Remove and replace any pile damaged by reason of internal defects, improper handling, or improper driving as directed by the engineer. If allowed by the engineer, submit other corrective measures for review and approval. Complete all corrective measures approved by the engineer at no expense to the department.

550.3.7.2 Penetration Resistance.
Drive piles to the depths necessary to obtain the required driving resistance as determined by the following formula (modified Gates).

$$P = \left(0.875\ x\ \sqrt{E}\ x \log\left(10/s\right)\right) - 50 \quad \text{(US Units)}$$

where:
P = nominal resistance in tons;
E = energy produced by the hammer per blow in foot-pounds; and
s = the average penetration in inches per blow for the final 10 to 20 blows.

For piles driven to a predominantly end bearing conditions the value of "s" shall be computed over a maximum distance of 1-inch. Additional pile driving may result in damage to the pile.

550.3.7.3 Pile Redriving
Under the Pile Redriving bid item, drive 15 percent of the piling in each substructure unit to plan length unless the required driving resistance is obtained at a shorter length. If the required driving resistance is not obtained in the plan length, allow the piling to set up for a minimum of 24 hours, then restrike. Determine the required driving resistance using the first ten blows of the hammer during restrike. If required driving resistance is still not obtained, splice additional length to the piling, drive the pile an additional 10 feet, or to the depth the engineer directs, and repeat the minimum 24-hour set up and restriking process. Add more length and repeat this entire process until the required driving resistance is obtained. After obtaining the required driving resistance, drive the other piling in the substructure to the same tip elevation.

Perform all restrike tests with the same pile driving system as will be used to drive the production piles.

Warm up the hammer by striking another pile a minimum of 20 blows prior to beginning the restriking operation.

550.3.8 Test Piles
When shown on the plans or required in the special provisions, furnish test piles of the length specified. Drive test piles at the locations shown on the plans. In each substructure unit, drive all test piles before driving any production piles in that unit.

Drive all test piles with the same pile driving system as will be used to drive the production piles.

Complete all excavation for the substructure unit before driving test piles.

Drive test piles to the required driving resistance. The engineer will determine the required penetration resistance by the methods and equations in 550.3.7.2. In addition, if a minimum tip elevation is shown on the plans, drive the piles to, or beyond, that elevation. Splice test piles if necessary.

550.3.9 Pre-Boring

550.3.9.1 General

If required by the plans or special provisions, make pre-bore holes to the depth indicated.

If not required by the plans or special provisions, submit request for pre-boring in writing for the engineer's review and approval. If approved by the engineer, complete such pre-boring at no expense to the department. Conduct the work so that the capacity of piles already in place will not be impaired. Repair or correct any damage to adjacent structures at no expense to the department.

550.3.9.2 Pre-Boring in Unconsolidated Materials

If round pile sections are used, make pre-bore holes approximately the same diameter as the pile section furnished. If other structural shapes are used, make the diameter of the pre-bore holes approximately the same as the greatest diagonal dimension of the section. If subsurface obstructions are encountered, increase the hole diameter to the least dimension necessary for pile installation.

Conduct pre-boring operations to maintain an open hole for pile installation. Use temporary casing if necessary in running or caving materials. Do not remove casing until the pile is placed in the pre-bore hole.

After completion of driving, backfill any void space remaining around the pile with sand or other approved materials.

550.3.9.3 Pre-Boring in Rock or Consolidated Materials

Pre-bore holes into rock or consolidated material to obtain both the minimum depth and the minimum penetration into rock as shown on the plans.

Case pre-bore holes as necessary to prevent introduction of unconsolidated material into the rock or consolidated material socket. Seat the casing firmly into the rock or consolidated material surface before beginning rock or consolidated material drilling.

If installing round pile sections, make the diameter of the pre-bore holes in the rock or consolidated material at least 1 inch larger than the outside diameter of the piles. If installing other structural shapes, make the diameter of the pre-bore holes at least 1 inch larger than the greatest diagonal dimension of the section.

Clear all debris from the pre-bore hole before installing the pile.

Firmly seat the piling after completion of preboring and backfill void spaces around the piles in the rock or consolidated material with a cement grout.

Remove the casing, and backfill any void spaces around the piles with sand or other approved materials.

Blasting to facilitate preboring operations is prohibited unless approved by the engineer.

550.3.10 Pile Points
Attach pile shoes in accordance to the manufacturer's instructions or as shown in the plans.

550.3.11 Finishing Piles

550.3.11.1 General
Cut off all piles to a true plane at the elevations shown on the plans. Cut off steel pile shells before placing concrete.

Take possession and properly dispose of all pile cut-offs.

For steel oil field pipe piles, remove all soil, water, and other materials within the pile to the bottom of the footing elevation. Fill any void below this elevation with material acceptable to the engineer or install a barrier acceptable to the engineer at or below this elevation.

550.3.11.2 Placing Concrete
Except as specified in this subsection, conform to section 501 for concrete core placement, protection, and curing.

Remove any accumulated water or other foreign material from inside of shell before placing concrete in the shell.

After the engineer inspects and approves the pile shells, deposit the concrete in each shell in one continuous operation in a manner and at a rate that causes no air pockets or cold joints. For pile shells with an inside diameter of 16 inches or less, concrete may be placed without the use of a tremie or downspout within the shell. Fill the shell completely with concrete and compact to a depth as great as practicable with a mechanical vibrator or by other means acceptable to the engineer.

Place steel reinforcement in the concrete as shown on the plans and ensure it is in the correct location when the level of concrete placement reaches the lower limits of the reinforcement.

Do not place concrete in shells that are within a 15 feet radius of other shells not yet driven. If this requirement cannot be met, cease pile-driving operations and do not resume until minimum concrete cures times are met or minimum compressive strengths are achieved. If high early strength concrete is used, the minimum cure time is 3 days. If concrete grades A-FA, A-S, A-T, A-IS, or A-IP are used, the minimum cure time is 14 days. For all other concrete, the minimum cure time is seven days. If test cylinders are used, do not resume pile driving until cylinders tests show a compressive strength of not less than 2500 psi, determined as specified under falsework removal in 502.3.4.2.

550.3.11.3 Painting

550.3.11.3.1 General
Paint the exposed portions of steel piles to conform to either the 2-coat paint system or the 3-coat paint system. Paint the piles from the top of the driven pile to a point not less than 4 feet below streambed or ground line. Paint adequate lengths of the pile to account for variable driven pile lengths. Paint the pile before driving.

Prepare the surface and apply the paint as specified in section 517, except blast clean the piling to conform to SSPC-SP6.

Handle painted piling with padded slings, nonmetallic slings, or softeners to minimize paint damage. Repair all damaged paint exposed above either water or ground line.

550.3.11.3.2 Two Coat Paint System

This system consists of paint from a department-approved manufacturer with a dry film thickness of 8 mils (0.20 mm) minimum and 10 mils (0.25 mm) maximum. Ensure a minimum cure time of 7 days elapses before exposing to water.

550.3.11.3.3 Three Coat Paint System

This system consists of a department-approved organic zinc rich primer and two coats of aluminum paint. Ensure that the aluminum paint for topcoats is made with aluminum pigment paste and varnish vehicle. Apply the two topcoats as follows:

1. Use a non-leafing pigment paste for the first topcoat.
2. Tint the first topcoat by adding Paste I Oil., as contained in ASTM D 261, in the proportion of 3 ounces per gallon of vehicle.
3. Allow two days cure time between coats of paint.
4. Do not apply aluminum paint to any portion of a pile that will be embedded in fresh Portland cement concrete.

550.4 Measurement

The department will measure Piling Steel HP (Size), Piling CIP Concrete (Size) (Shell Thickness), and Piling Precast Concrete (Size) by the linear foot acceptably completed. The measured quantity equals the lengths of piling delivered, driven, and left in place below cutoff elevation.

The department will measure Piling Precast Concrete Testing by the linear foot ordered and delivered. The measured quantity equals the lengths of piling driven and left in place below cutoff elevation.

The department will measure Pile Points as each individual unit acceptably installed and driven.

The department will measure Pre-Boring (Unconsolidated Material) and Pre-Boring (Rock) by the linear foot acceptably completed, from the footing base to the depth shown on the plans or directed by the engineer.

The department will measure Pile Splices Precast Concrete (Size), as each individual splice acceptably completed meeting the following limitations:

1. No splices will be measured for Piling Precast Concrete (Size) fabricated to plan length.
2. No splices will be measured for Piling Precast Concrete Testing fabricated to plan length.
3. No more than 1 splice per 20 linear feet of piling length in excess of plan length will be measured.

The department will measure Pile Redriving as each individual restrike. There may be multiple restrikes per pile within a substructure.

550.5 PAYMENT

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
550.0010.S	Pre-Boring Unconsolidated Materials	LF
550.0020.S	Pre-Boring (Rock)	LF
550.0500.S	Pile Points	Each
550.0600.S	Pile Redriving	Each
550.1100.S	Piling Steel HP (Size)	LF
550.2102.S – 2168.S	Piling CIP Concrete (Size) (Shell Thickness)	LF
550.3010.S	Piling Precast Concrete Testing	LF
550.3100.S – 3160.S	Piling Precast Concrete (Size)	LF
550.3810.S – 3816.S	Pile Splices, Precast Concrete (Size)	Each

Payment for the Piling (Type) (Size) bid items is full compensation for fabricating, furnishing, and delivering acceptable piling; for preparing, driving, and cutting off piles; for re-driving heaved up piles when necessary; for furnishing, placing, curing, and protecting concrete when required; for painting when required; for disposal of cutoffs not used; and for removal of material within the footing perimeter heaved up by pile driving operations.

Payment for the Piling Precast Concrete Testing is full compensation for preparing, driving, and cutting off piles; for re-driving heaved up piles when necessary; for furnishing, placing, curing, and protecting concrete when required; for painting when required; for disposal of cutoffs not used; and for removal of up-heaved materials within the footing perimeter.

The department will pay an amount equivalent to the contract price for 6 feet of Piling Steel HP (Size) or 6 feet of Piling CIP Concrete (Size) (Shell Thickness), whichever is appropriate, for field splices. The department will pay for one splice per pile under the Splices HP Piling administrative item. The department will pay for splices meeting the following conditions:

1. The required driving resistance cannot be achieved in the length shown on the plans.
2. The pile is spliced per the specification.
3. The spliced pile is acceptably driven to the plan required driving resistance.

Payment for the Pile Splices, Precast Concrete (Size) is full compensation for preparing the precast concrete pile, furnishing all materials, and acceptably completing all measured splices.

The department will not pay separately or additionally for providing a pile fabricated from cutoffs as allowed under 550.3.3.

Payment for Pile Points is full compensation for providing and attaching the units.

Payment for Pre-Boring (Unconsolidated Materials) is full compensation for drilling the pre-boring holes of the required diameter to the required depth; for all means and materials necessary to maintain an open hole; for backfilling around piles when necessary; and for disposal of all excess material.

Payment for Pre-Boring (Rock or Consolidated Material) is full compensation for drilling the pre-boring holes of the required diameter to the required depth; for furnishing; installing, and removing temporary casing; for furnishing and placing required backfill materials around piles when required; and for disposal of all excess material.

Payment for Pile Redriving is full compensation for time delays, extra movement of equipment for each pile restriking operation.

END OF SECTION ITEMSPV.550.2102.S PILING STEEL HP 12X5

ITEM L-108 INSTALLATION OF UNDERGROUND CABLE FOR AIRPORT

1. DESCRIPTION

1.1 This item shall consist of underground cable, furnished and installed, in accordance with this specification at the locations and in accordance with the design, dimensions, and details shown on the Plans. This item shall include the excavation and backfill of the trench and the installation of cable and counterpoise wire in trench, duct or conduit. It shall include splicing, cable marking, and testing of the installation and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the Engineer.

1.2 This item shall also include the removal and disposal of existing cabling in existing conduit.

1.3 This item shall also include location and protection of existing cables during construction.

2. EQUIPMENT AND MATERIALS

2.1 General.

(a) Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20591, and shall be listed in the current Advisory Circular 150/5345-53, Approved Airport Equipment.

(b) All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.

2.2 Lighting Cable. Underground cable shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits. The following types are covered in Specification L-824:

(a) Type A. Not allowed.

(b) Type B. Not allowed.

(c) Type C. Single and multiple conductor cable rated 600-volts and 5,000-volts having cross-linked polyethylene insulation. Multiple conductor cables shall have an overall jacket.

Where counterpoise conductors are to be installed and where soil conditions would adversely affect bare copper wire, thermoplastic wire conforming to Federal Specification J-C-30, Type TW, 600 volt, may be used.

Cable type, size, number of conductors, strand and service voltage shall be specified in the plans and/or proposal.

2.3 Bare Copper Wire (Counterpoise). Bare copper wire for counterpoise installations shall be

stranded wire conforming to ASTM Specifications B3 and B8.

2.4 Cable Connections. In-line connections of underground primary cables shall be of the type called for on the plans and shall be one of the types listed below. When the permit a choice of connection, the Contractor shall indicate in the bid the type of connection he proposes to furnish.

(a) The Cast Splice. Can be used on cables rated 600V or less only. A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by Minnesota Mining and Manufacturing Company, “Scotchcast” Kit No. 82—B, or as manufactured by Hysol Corporation, “Hyseal Epoxy Splice” Kit No. E1135, or equivalent, is used for potting the splice is acceptable.

(b) The Vulcanized Splice. Not used.

(c) The Field-Attached Plug-in Splice. Figure 3 of AC 150/5345-26, Specification L-823 Plug and Receptacle, Cable Connectors, employing connector kits, is approved for field attachment to single conductor cable.

(d) The Factory-Molded Plug-in Splice. Specifications for L-823 Connectors, Factory-Molded to Individual Conductors, are approved.

(e) The Taped Splice. Not used.

(f) Heat Shrink Kit. All plug-in splices shall be covered with an approved "heat shrink" kit. This shall include all new splices and where all reconnection of existing splices are required.

2.5 Power Cable Splices. Power cable shall be spliced with 3M splice kits employing epoxy resin encapsulation. The kit used shall be of the No. 82A series, selected to fit the size of the cable as recommended by the manufacturer. Shielded cables shall have the ends of the shielding bonded together across the splice to provide a continuous electrical path.

2.6 Splicer Qualifications. Every airfield lighting cable splicer shall be qualified in making cable splices and terminations on cables rated above 5000 volts AC. The Contractor shall submit to the Engineer proof of the qualifications of each proposed cable splicer for the cable type and voltage level to be worked on. Cable splicing/terminating personal shall have a minimum of three (3) years of continuous experience in terminating/splicing medium voltage cable.

2.7 Concrete. Concrete for cable markers shall conform to Specification Item P-610, "Structural Portland Cement Concrete."

2.8 Electrical Coating. Scotchkote shall be as manufactured by Minnesota Mining and Manufacturing Company, or approved equivalent.

2.9 Existing Circuits. Whenever the scope of work requires connection to an existing circuit, the circuit’s insulation resistance shall be tested, in the presence of the Engineer. The test shall be performed in accordance with this item and prior to any activity affecting the respective circuit. The Contractor shall record the results on forms acceptable to the Engineer. When

the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the Engineer. The Contractor shall record the results on forms acceptable to the Engineer. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All tests results shall be submitted in the Operations and Maintenance (O & M) Manual.

3. CONSTRUCTION METHODS

3.1 General. The Contractor shall install the specified cable at the approximate locations indicated in the airport lighting layout plans. The Engineer shall indicate specific locations.

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual insulating transformers. The Contractor shall 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 or shown on the plans.

3.2 Installation in Duct or Conduit. 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 shall be in accordance with the latest National Electric Code, or the code of the local agency having jurisdiction. The Contractor shall make no connections or joints of any kind in cables installed in conduits or ducts.

The duct or conduit shall be installed as a separate item in accordance with Item L-11O, "Installation of Airport Underground Electrical Duct." The Contractor shall make sure that the duct is open, continuous, and clear of debris before installing cable. The cable shall 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 shall be sealed with moisture-seal tape before pulling into the conduit and it shall 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 shall be pulled in the 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. Pulling tensions should be governed by recommended standard practices for straight pulls or bends. A lubricant recommended for the type of cable being installed should be used where pulling lubricant is required. Duct or conduit markers temporarily removed for excavations shall be replaced as required.

3.3 Trenching. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Road patrols or graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be

excavated to a minimum depth of 18 inches for lighting and 36 inches for control below finished grade, except as follows:

(a) When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches unless otherwise specified.

(b) Minimum cable depth when crossing under a railroad track, shall be 60 inches unless otherwise specified.

The Contractor shall excavate all cable trenches to a width not less than 6 inches. The trench shall be widened where more than two cables are to be installed parallel in the same trench. Unless otherwise specified in the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock excavation is encountered, the rock shall be removed to a depth of at least 3 inches below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch sieve. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All excavation shall be unclassified.

3.4 Installation in Trenches. The Contractor shall not use a cable plow for installing the cable. Mechanical cable laying equipment may be used in conjunction with a trenching machine if specified on project plans and specifications; and it should provide for physical inspection of cable prior to backfilling. Sharp bends or kinks in the cable shall not be permitted. Cables shall be unreeled in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end.

Where two or more cables are laid parallel in the same trench, they shall be placed laterally a minimum distance of 3 inches apart, and the trench shall be widened sufficiently to accomplish this.

Cables crossing over each other shall have a minimum of 3-inch vertical displacement with the topmost cable depth at or below the minimum required depth below finished grade.

Not less than 3 foot of cable slack shall be left on each side of all connections, insulating transformers, light units, and at all other points where cable is connected to field equipment. The slack cable shall be placed in the trench in a series of S curves. Additional slack cable shall be left in runway light bases, handholes, manholes, etc., where it is required to bring the cable above ground level to make connections. The amount of slack cable shall be stipulated by the Engineer, or as shown on the plans and specifications.

3.5 Backfilling. After the cable has been installed, the trench shall be backfilled. The first layer of backfill shall be 3 inches deep, loose measurement, and shall be either earth or sand containing no mineral aggregate particles that would be retained on a ¼-inch sieve. This layer shall not be compacted. The second layer shall be 5 inches deep, loose measurement, and shall contain no particles that would be retained on a l-inch sieve. The remainder of the backfill shall be excavated or imported material and shall not contain stone or aggregate

larger than 4 inches maximum diameter. The third and subsequent layers of the backfill shall not exceed 8 inches in maximum depth, loose measurement. The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil, and to the satisfaction of the Engineer. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations. The trench shall be completely backfilled and tamped level with the adjacent surface, except that when sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement. Any excess excavated material shall be removed and disposed of in accordance with instructions issued by the Engineer.

3.6 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction, and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging or mulching. All such work shall be performed in accordance with the FAA standard turfing specifications. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

3.7 Cable Markers. Not used.

3.8 Splicing. Connections of the type shown in the plans shall be made by experienced personnel regularly engaged in this type of work and shall be made as follows:

(a) Cast Splices. Can be used on cables rated 600V or less. These shall be made by using crimp connectors for jointing conductors. Molds shall be assembled, and the compound shall be mixed and poured in accordance with manufacturer’s instructions and to the satisfaction of the Engineer.

(b) Vulcanized Splices. Not used.

(c) Field-Attached Plug-in Splices. These shall be assembled in accordance with manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. In all cases the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint.

(d) Factory-Molded Plug-in Splices. These shall be made by plugging directly into mating connectors. In all case, the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint. Heat-shrink kit shall be applied to each plug.

(e) Taped Splices. Not used.

(f) Apply heat shrink kit splice covers according to manufacturer's instructions

(g) Install circuit identification tags on new and old circuits in all manholes on the circuit route.

3.9 Bare Counterpoise Wire Installation and Grounding for Lightning Protection. Where shown on the plans or specified in job specifications, a solid bare copper wire, No. 6 AWG minimum size, shall be installed for lightning protection of the underground airfield cables. The bare counterpoise wire shall be installed for the entire length of the insulated cable it is designed to protect, and, unless specified otherwise, shall be placed in its own trench located horizontally half the distance between the lighting cable and the concrete pavement edge and at half the depth of the lighting cable. The counterpoise wire shall be securely attached to copper or copper-clad ground rods installed not more than 500 feet apart around the entire circuit and at the beginning and end of each counterpoise circuit. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 10-feet long nor less than 3/4 inch in diameter. The tops of the ground rods shall be installed 10-inches below grade.

Where shown on the plans or specified in the job specifications, a stranded bare copper wire, No. 1/0 AWG, shall be installed for lightning protection of the underground FAA cables. The 1/0 AWG counterpoise (guard wire) shall be installed under the 918c specification.

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 counterpoise system shall terminate at the structures that enclose the power source for the circuit protected. The connections shall be made as shown in the project plans and specifications.

3.10 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the underground cable circuits after installation. The Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

(a) That all lighting, power, and control circuits are continuous and free from short circuits.

(b) That all circuits are free from unspecified grounds.

(c) That the insulation resistance to ground of all nongrounded series circuits is not less than 50 megohms.

(d) That the insulation resistance to ground of all nongrounded conductors of multiple circuits is not less than 50 megohms.

(e) That all circuits are properly connected in accordance with applicable wiring diagrams.

(f) That all circuits are operable. Tests shall 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.

3.11 Temporary Cabling. The contractor shall install, maintain, and remove when no longer needed, temporary (jumper) cable necessary to keep lighting circuits operational during the construction work as directed or approved by the Airport Engineer. The temporary (jumper) cables shall be installed direct earth buried (DEB) a minimum 6" below grade as shown in the plans.

All temporary cabling shall be placed in existing conduit or ducts as shown on the plans. Temporary cable shall not be left exposed at any location. If temporary cable is to be placed at a location where no raceway or duct exists through which to run the cable, the temporary cable shall be installed in either a.) a trench, 6 inches deep and backfilled with excavated material, or b.) temporary PVC or poly duct, appropriate size and placed along the surface as directed, and conspicuously marked with red tape and flags. Where the temporary cables are extended from existing light bases or electrical manholes and across the surface of existing shoulders they shall be enclosed in PVC or rigid steel electrical conduit routed directly to the shoulder edge. The conduit shall be temporarily secured to the shoulder surface with strapping anchored to the pavement or with small sandbags placed every five feet.

Upon completion of the work, the contractor shall remove all temporary (jumper) cable, conduit, and anchors, and backfill any trenches to the satisfaction of the engineer.

3.12 Location and Protection of Existing Cables and Equipment. All existing cables are shown on the PLANS to the best of the Engineer's knowledge and are approximate only. The contractor working with the airport's representative shall locate all cables prior to any trenching, digging, or boring. The contractor shall provide toning equipment capable of detecting a 60 Hz signal for locating cables in the construction area. The contractor shall contact Diggers Hotline a minimum of 5 business days in advance of underground work to locate non-airport or FAA owned utilities.

The contractor shall be responsible for protection of existing cables, whether owned by the airport or other agencies or companies operating within the project boundaries. Any cables or equipment damaged in the process of construction shall be repaired or replaced as needed as soon as possible. **The cost of cable repair shall be borne by the contractor. Any damage claims due to damaged or cut cable(s) shall also be borne by the contactor.** Notify the Engineer and the Airport as soon as cable/equipment are compromised.

4. METHOD OF MEASUREMENT

4.1 The quantity of cable or counterpoise wire installed in trench, conduit, or duct to be paid for shall be the number of linear feet of cable or counterpoise wire installed, measured in place, completed, ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable type or counterpoise wire installed.

4.2 Measurement for the purposes of payment shall be the center to center distance from light base to light base or manhole to light base as the case may be, along the path of the conduit in which the cable is installed. An additional THREE (3) feet of cable will be installed at each light base and THIRTY (30) feet of cable installed at each manhole to provide for the required cable slack at those locations.

4.3 Measurement for payment will be made for cable removal in conduit or duct as shown on the plans and as directed by the Airport Engineer. Measurement for the purposes of payment shall be as described in paragraph 4.2 above.

4.4 Measurement for payment will be made for existing cable location and protection, including electrical equipment, shall be made per a lump sum.

5. BASIS OF PAYMENT

5.1 Payment will be made at the contract unit price for cable, and bare counterpoise wire installed in trench, conduit, or duct, by the Contractor and accepted by the Engineer. Any trenching or plowing required for direct bury cable or counterpoise shall be incidental to the respective pay item. Ground rods shall be incidental to the counterpoise.

5.2 Payment will be made at the contract unit price for the removal of cabling in existing lighting ductwork or conduit. This price shall be full compensation for furnishing all materials and for all preparation, installation, maintenance and removal of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-108-5.1	#6 AWG, Bare Solid Copper Counterpoise Wire	-per linear foot
L-108-5.2	Locate and Protect Existing Circuits and Equipment	-per lump sum

MATERIAL REQUIREMENTS

AC 150/5345-7	Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle Cable Connectors
Fed. Spec. J-C-30	Cable and Wire, Electrical Power, Fixed Installation

HH-I-595	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic, for Low-Temperature Application
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductor, Hard Medium-Hard, or Soft
MIL-I-3825	Insulation Tape, Electrical, Self-Fusing, For Use in Electronics, Communications, and Allied Equipment
MIL-I-7798	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

END OF SECTION ITEM L-108 INSTALLATION OF UNDERGROUND CABLE FOR AIRPORT

ITEM L-110 ELECTRICAL DUCT BANK

1. DESCRIPTION

1.1 This item shall consist of underground electrical ducts or conduits installed in accordance with this specification at the locations and in accordance with the dimensions, designs, and details shown on the plans. It shall also include all trenching, backfilling, pavement saw cutting, removal and restoration of all paved and unpaved areas; concrete encasement, mandreling installation of poly-filament drag lines and duct markers, capping, and the testing of the installation as a completed duct system ready for installation of cables, to the satisfaction of the Engineer.

2. EQUIPMENT AND MATERIALS

2.1 General. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

2.2 Steel Conduit. Shall be used only as stated on the plans. Rigid galvanized steel conduit and fittings shall be hot dipped, galvanized inside and out and conform to the requirements of Underwriters Laboratories Standard 6, 514B, and 1242.

2.3 Concrete. Concrete shall conform to Item P-610, Structural Portland Cement Concrete, and using 1-inch maximum size coarse aggregate with a minimum 28 day compressive strength of 4000 psi. Where reinforced duct banks are specified, reinforcing steel shall conform to ASTM A 615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

2.4 Plastic Conduit. Plastic conduit and fittings shall conform to the requirements of Federal Specification W-C-1094 and shall be one of the following, as specified in the proposal:

(a) Type I - suitable for underground use encased in concrete.

(b) Type II - suitable for either above ground or underground use.

2.5 Flexible Conduit. Not Used.

2.6 Detectable Warning Tape. Plastic, detectable, magnetic tape shall be polyethylene film with a metalized foil core and shall be 4-6 inches wide. Detectable tape is incidental to the respective bid item.

3. CONSTRUCTION METHODS

3.1 General. The Contractor shall install underground ducts at the approximate locations indicated on the lighting layout plans. The Engineer shall indicate specific locations as the work progresses. Ducts shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or specifications, the ducts shall be not less than 3 inches inside diameter. All duct lines shall be laid so as to slope toward

handholes, manholes and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to maintain the grade all one way, the duct lines shall be sloped from the center in both directions toward manholes, handholes, or duct ends. Pockets or traps where moisture may accumulate shall be avoided.

The Contractor shall mandrel each duct. An iron-shod mandrel, not more than 1/4 inch smaller than the bore of the duct, shall be pushed through each duct by means of jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.

All ducts installed shall be provided with a poly-filament dragline for pulling the permanent wiring. Sufficient length shall be left in manholes or handholes to tie off the dragline and prevent it from slipping back into the duct. Where spare ducts are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed by the duct manufacturers, or with hardwood plugs conforming accurately to the shape of the duct and having the larger end of the plug at least 1/4 inch greater in diameter than the duct.

All ducts shall be securely fastened in place during construction and progress of the work and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.

All ducts, except steel conduit, installed under runways, taxiways, aprons, and other paved areas shall be encased in a concrete envelope.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for ducts may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of road patrols or graders shall not be used to excavate the trench. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All excavation shall be unclassified.

3.2 Ducts Encased in Concrete. Unless otherwise shown on the plans, concrete-encased ducts shall be installed so that the top of the concrete envelope is not less than 18 inches below the finished subgrade where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches below finished grade where installed in unpaved areas. Ducts under paved areas shall extend at least 3 feet beyond the edges of the pavement or 3 feet beyond any underdrains, which may be installed alongside the paved area. Trenches for concrete-encased ducts shall be opened the complete length before concrete is laid so that if any obstructions are encountered, proper provisions can be made to avoid them. All ducts for concrete encasements shall be placed on a layer of concrete not less than 3 inches thick prior to its initial set. Where two or more ducts are encased in concrete, the Contractor shall space them not less than 1-1/2 inches apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than 3 inches thick shall be placed around the sides and top of the duct bank. End bells or couplings shall be installed flush with the concrete encasement where required.

When specified, the Contractor shall reinforce the bottom side and top of encasements with

steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where otherwise shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers or piles located at approximately 5-foot intervals.

All joints in a bank of single-bore ducts shall be staggered, beginning evenly from the manhole or handhole, by means of short lengths 6, 8, 9, 12, and 15 inches long. Cement mortar shall be troweled around each and every joint. Voids in the duct bank, caused by the external shape of the corners of the conduit, shall also be filled with mortar. The joining and joints of soapstone duct shall be done in accordance with the manufacturer's recommendations.

3.3 Ducts Without Concrete Encasement. Trenches through turf areas for single-duct lines shall be not less than 6 inches nor more than 12 inches wide, and the trench for 2 or more ducts installed at the same level shall be proportionately wider. Trenches through existing pavement shall be sawcut on each side of the trench the full depth of the existing pavement and to the width detailed on the plans. Removal of existing pavement and excavation of material below shall be accomplished so as to prevent damage to adjacent pavement.

Trench bottoms for ducts without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the duct along its entire length.

A layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the duct. The bedding material shall consist of soft dirt, sand or other fine fills, and it shall contain no particles that would be retained on a 1/4-inch sieve. The bedding material shall be tamped until firm.

Unless otherwise shown on the plans, ducts for direct burial shall be installed so that the tops of all ducts are at least 18 inches below the finished grade.

When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction.

Trenches shall be opened the complete length before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.

3.4 Duct Markers. The location of the ends of all ducts shall be marked by a concrete slab marker 2 feet square and 4 inches thick extending approximately 1-inch above the surface. The markers shall be located above the ends of all ducts or duct banks, except where ducts terminate in a handhole, manhole, or building.

The Contractor shall impress the word "DUCT" on each marker slab. He shall also impress on the slab the number and size of ducts beneath the marker. The letters shall be 4 inches high and 3 inches wide with width of stroke 1/2 inch and 1/4 inch deep or as large as the available space permits.

3.5 Backfilling. After concrete-encased ducts have been properly installed and the concrete has

had time to set, the trench shall be backfilled in at least two layers with excavated material not larger than 4 inches in diameter and thoroughly tamped and compacted to at least the density of the surrounding undisturbed soil. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations. The trench shall be completely backfilled and tamped level with the adjacent surface; except that, when sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of in accordance with instructions issued by the Engineer.

For ducts without concrete envelope, 8 inches of sand, soft earth, or other fine fill (loose measurement) shall be placed around the ducts and carefully tamped around and over them with hand tampers. The remaining trench may be filled with regular run of excavated material and thoroughly tamped as specified above.

Ducts installed in trenches through existing pavement shall be backfilled full-depth with concrete. The concrete shall be struck level with the surrounding pavement and finished for a smooth, sound, and durable surface.

3.6 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, sprigging, or mulching. All such work shall be performed in accordance with the FAA Standard Turfing Specifications. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

4. METHOD OF MEASUREMENT

4.1 Underground electrical duct will be measured by the number of linear feet of duct bank or single-run conduit installed, measured in place, completed and accepted. Separate measurement will be made for the various types and sizes. Conduits noted as Type I shall be concrete encased and measurement shall include all reinforcement and concrete as well as trench restoration. Conduits noted as Type II shall be direct buried.

4.2 Trenching and Restoration shall be measured per linear foot. This item will be for conduit installed in turf runs, and not under pavement. Conduit installed under pavement will not have a trenching and restoration as a bid item.

5. BASIS OF PAYMENT

5.1 Payment will be made at the contract unit price for each type and size of conduit completed and accepted. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-110-5.1	Electrical Duct Bank, 2W-2”, Schedule 40 PVC, Type I	-per linear foot
L-110-5.2	Electrical Duct Bank, 2W-4”, Schedule 40 PVC, Type I	-per linear foot

6. MATERIAL REQUIREMENTS

Fed. Spec. W-C-571	Conduit and Fittings, Nonmetal, Rigid; (Asbestos- Cement or Fire-Clay Cement), (for Electrical Purposes)
Fed. Spec. W-C-1094	Conduit and Fittings, Nonmetallic, Rigid, (Plastic)
Underwriters Laboratories	Rigid Metal Conduit Standard 6
Underwriters Laboratories	Fittings for Conduit and Outlet Standard 514 Boxes
Underwriters Laboratories	Impregnated-Fiber Electrical Standard 543 Conduit
Underwriters Laboratories	Intermediate Metal Conduit Standard 1242

END OF SECTION ITEM L-110 ELECTRICAL DUCT BANK

ITEM L-115 ELECTRICAL HANDHOLES AND JUNCTION STRUCTURES

1. DESCRIPTION

115-1.1 This item shall consist of electrical handholes and junction structures (handholes, pullboxes, junction cans, etc.) installed in accordance with this specification, at the indicated locations and conforming to the lines, grades and dimensions shown on the plans or as required by the Engineer. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, frame, covers, chimney extension rings, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the Engineer.

2. EQUIPMENT AND MATERIALS

115-2.1 GENERAL.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

115-2.2 CONCRETE STRUCTURES. Cast-in-place concrete structures shall conform to the details and dimensions shown on the plans.

Provide precast concrete structures where shown on the plans. Precast concrete structures shall be an approved standard design of the manufacturer. Precast units shall have mortar or bitumastic sealer placed between all joints to make them watertight. The structure shall be designed to withstand [100,000 lbs. aircraft] loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

Threaded inserts and pulling eyes shall be cast in as shown.

If the Contractor chooses to propose a different structural design, signed and sealed shop drawings, design calculations, and other information requested by the Engineer shall be submitted by the Contractor to allow for a full evaluation by the Engineer. The Engineer shall review in accordance with the process defined in the General Provisions.

115-2.3 JUNCTION PULL CANS. Junction Cans shall be L-867 Class 1 (non-load bearing) or L-868 Class 1 (load bearing) cans encased in concrete. The cans shall have a galvanized steel blank cover, gasket, and stainless steel hardware. Covers shall be 3/8" thickness for L-867 and 3/4" thickness for L-868. Where noted, L-868 cans shall be 2-piece to facilitate pavement operations. L-868 base cans installed in pavement shall be set in place using a manufacturer recommend setting jig to assure can placement will meet the exact level and future fixture orientation requirements. Provide two (2) external ground lugs on all L-868 base cans for installation of a counterpoise wire. Refer to detail sheets of plan set for installation sequence of work. In-pavement 2 piece cans shall include coring and P-606 as shown on the details.

115-2.4 NON-CONCRETE STUCTURES. Non-concrete handholes shall follow the same requirements as the lockable handholes specification.

115-2.5 MORTAR. The mortar shall be composed of one part of portland cement and two parts of mortar sand, by volume. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15 percent of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C 6. The water shall be clean and free of deleterious amounts of acid, alkalies or organic material. If the water is of questionable quality, it shall be tested in accordance with AASHTO T-26.

115-2.6 CONCRETE. All concrete used in structures shall conform to the requirements of Item P-610, Structural Portland Cement Concrete.

115-2.7 FRAMES AND COVERS. The frames shall conform to one of the following requirements:

a. Gray iron castings shall meet the requirements of ASTM A 48, Class 30B and 35B.

b. Malleable iron castings shall meet the requirements of ASTM A 47.

c. Steel castings shall meet the requirements of ASTM A 27.

d. Structural steel for frames shall conform to the requirements of ASTM A-283, Grade D.

e. Ductile iron castings shall conform to the requirements of ASTM A 536.

f. Austempered ductile iron castings shall conform to the requirements of ASTM A 897.

All castings specified shall withstand an H-20 [100,000 psi] load.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A 123.

Each cover shall have the word "ELECTRIC" or other approved designation cast on it. Each frame and cover shall be as shown on the plans or approved equivalent. No cable notches are required.

115-2.8 LADDERS. Provide climbing rungs and ladders in manholes. Ladders shall be of sufficient length to hook over the bottom climbing rung in the chimney and shall be hot dipped galvanized steel.

115-2.9 REINFORCING STEEL. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A 615, Grade 60.

115-2.10 BEDDING/SPECIAL BACKFILL. Bedding or special backfill shall be as shown on the plans.

115-2.11 FLOWABLE BACKFILL. Flowable material used to backfill shall conform to the requirements of Item P-153 "Controlled Low Strength Material".

115-2.12 CABLE TRAYS. Cable trays shall be of galvanized steel, plastic, or aluminum. Cable trays shall be located as shown on the plans.

115-2.13 PLASTIC CONDUIT. Plastic conduit shall comply with Item L-110 - Airport Underground Electrical Duct Banks and Conduits.

115-2.14 CONDUIT TERMINATORS. Conduit terminators shall be pre-manufactured for the specific purpose and sized as required or as shown on the plans.

115-2.15 PULLING-IN IRONS. Pulling-in irons shall be manufactured with 7/8-inch (22mm) diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2-inch diameter with an ultimate strength of 270,000 psi). Where stress-relieved carbon steel roping is used, a rustproof sleeve shall be installed at the hooking point and all exposed surfaces shall be encapsulated with a polyester coating to prevent corrosion.

115-2.16 GROUND RODS. Ground rods shall be one piece, copper or copper clad. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 8-feet (240 cm) long nor less than 5/8 inch (15 mm) in diameter.

115-2.17 6” PVC PIPE. Non-perforated drain pipe shall comply with D-705 – Pipe Underdrain for Airports.

3. CONSTRUCTION METHODS

115-3.1 UNCLASSIFIED EXCAVATION. It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the Engineer without additional expense to the Owner.

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.

All excavation shall be unclassified and shall be considered incidental to the respective L-115 pay item of which it is a component part. Dewatering necessary for L-115 structure installation, erosion and turbidity control, in accordance with Federal, State, and Local requirements is incidental to its respective pay item as a part of Item L-115. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-115 Item.

Boulders, logs and all other objectionable material encountered in excavation shall be removed. All rock and other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Engineer. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

The Contractor shall provide all bracing, sheeting and shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting and shoring shall be included in the unit price bid for the structure.

Unless otherwise provided, bracing, sheeting and shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

After each excavation is completed, the Contractor shall notify the Engineer. Structures shall be placed after the Engineer has approved the depth of the excavation and the suitability of the foundation material.

Prior to installation the Contractor shall provide a minimum of 6 inches of sand or a material approved by the Engineer as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

115-3.2 CONCRETE STRUCTURES. Concrete structures shall be built on prepared foundations conforming to the dimensions and form indicated on the plans. The concrete and construction methods shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is placed.

115-3.3 PRECAST UNIT INSTALLATIONS. Precast units shall be installed plumb and true. Joints shall be made watertight by use of sealant at each tongue-and-groove joint and at roof of manhole. Excess sealant shall be removed and severe surface projections on exterior of neck shall be removed.

115-3.4 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer and shall 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 shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

Field connections shall be made with bolts, unless indicated otherwise. Welding will not be permitted unless shown otherwise on the approved shop drawings and written permission is granted by the casting manufacturer. Erection equipment shall be suitable and safe for the workman. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the Engineer and approval of the method of correction shall be obtained. Approved corrections shall be made at Contractor's expense.

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

Pulling-in irons shall be located opposite all conduit entrances into structures to provide a strong, convenient attachment for pulling-in blocks when installing cables. Pulling-in irons shall be set directly into the concrete walls of the structure.

115-3.5 INSTALLATION OF LADDERS. Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.

115-3.6 REMOVAL OF SHEETING AND BRACING. In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than six (6) inches of material is placed above the top of the structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

The Engineer may order the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

115-3.7 BACKFILLING. After a structure has been completed, the area around it shall be backfilled in horizontal layers not to exceed 6 inches in thickness measured after compaction to the density requirements in Item P-152. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the Engineer.

Backfill shall not be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission shall not be given until tests made by the laboratory under supervision of the Engineer 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.

Where required, the Engineer may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

115-3.8 CONNECTION OF DUCT BANKS. To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

115-3.9 GROUNDING. A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches (154 mm) above the floor. The ground rod shall be installed within 1 foot of a corner of the concrete structure. Ground rods shall 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 shall drill a 4-inch diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of 1 foot above the floor of the structure and separate from other cables. No. 2 AWG bare copper pigtails shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. Hardware connections may be mechanical, using a lug designed for that purpose.

115-3.10 CLEANUP AND REPAIR. After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound conforming MIL-P-21035. Surfaces shall be prepared and compound applied in accordance with manufacturer's recommendations.

Prior to acceptance, the entire structure shall be cleaned of all dirt and debris.

115-3.11 RESTORATION. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective L-115 pay item.

The Contractor shall grade around structures as required to provide positive drainage away from the structure.

Areas with special surface treatment, such as roads, sidewalks, or other paved areas shall have backfill compacted to match surrounding areas, and surfaces shall be repaired using materials comparable to original materials.

After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clear and in good condition.

115-3.12 INSPECTION. Prior to final approval, the electrical structures shall be thoroughly inspected for conformance with the plans and this specification. Any indication of defects in materials or workmanship shall be further investigated and corrected. The earth resistance to ground of each ground rod shall not exceed 25 ohms. Each ground rod shall be tested utilizing the fall-of-potential ground impedance test as described by ANSI IEEE Standard 81. This test shall be performed prior to establishing connections to other ground electrodes.

115-3.13 Manhole Elevation Adjustments. The Contractor shall adjust the tops of existing manholes in areas designated in the Contract Documents to the new elevations shown. The Contractor shall be responsible for determining the exact height adjustment required to raise the top of each manhole to the new elevations. The existing top elevation of each manhole to be adjusted shall be determined in the field and subtracted/added from the proposed top elevation.

The Contractor shall remove/extend the existing top section or ring and cover on the manhole structure or manhole access. The Contractor shall then install precast concrete sections or grade rings of the required dimensions to adjust the manhole top to the new proposed elevation or shall cut the existing manhole walls to shorten the existing structure, as required by final grades. Finally, the Contractor shall reinstall the manhole top section or ring and cover on top and check the new top elevation.

The Contractor shall construct a concrete slab around the top of adjusted structures located in graded areas that are not to be paved. The concrete slab shall conform to the dimensions shown on the plans.

115-3.14 Duct Extension to Existing Ducts. Where existing concrete encased ducts are to be extended, the duct extension shall be concrete encased plastic conduit. The fittings to connect the ducts together shall be standard manufactured connectors designed and approved for the purpose. The duct extensions shall be installed according to the concrete encased duct detail and as shown on the plans.

4. METHOD OF MEASUREMENT

115-4.1 Electrical manholes and junction structures shall be measured by each unit completed in place and accepted. The following additional items are specifically included in each unit.

- All Required Excavation, Dewatering
- Sheeting and Bracing
- All Required Backfilling with On-Site Materials
- Restoration of All Surfaces and Finished Grading, Sodding
- All Required Connections
- Coring and sealing (for in-pavement cans)
- Temporary Cables and Connections
- Ground Rod Testing
- 6” PVC Drain Pipe

5. BASIS OF PAYMENT

115-5.1 The accepted quantity of electrical and communication handholes and junction structures will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, coring, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-115-5.1	Handhole (Spring Assist)	- per each
L-115-5.2	Handhole (Lockable)	- per each

MATERIAL REQUIREMENTS

ANSI/IEEE Std 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle Cable Connectors
FED SPEC J-C-30	Cable and Wire, Electrical Power, Fixed Installation (cancelled; replaced by AA-59544 Cable and Wire, Electrical (Power, Fixed Installation))
ASTM B.3	Soft or Annealed Copper Wire
ASTM B.8	Concentric-Lay-Stranded Copper Conductor, Hard, Medium-Hard, or Soft
ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM C150	Portland Cement
ASTM C144	Aggregate for Masonry Mortar
ASTM A27	Mild to Medium Strength Carbon Steel Castings for General Application
ASTM A47	Malleable Iron Castings
ASTM A48	Gray Iron Castings
ASTM A123	Zinc (Hot Galvanized) Coating on Products Fabrication from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
ASTM A897	Low and Intermediate Strength Carbon Steel Plates, Shapes, and Bars
ASTM A536	Ductile Iron Castings

END OF SECTION ITEM L-115 ELECTRICAL HANDHOLES AND JUNCTION STRUCTURES

ITEM L-152 FIBER OPTIC CABLE

1. DESCRIPTION

1.1 Scope of Work. The work specified in this section shall include the installation of a 6 strand, single mode fiber optic cable run between the communication enclosure and IDF-4 in the South Maintenance Building as shown on the plans. This work includes new handholes, conduit, fiber optic cable, terminations and testing.

The Contractor shall coordinate with the Airport before work begins to coordinate the down time to existing systems.

2. EQUIPMENT AND MATERIALS

2.1 General. All equipment and materials covered by referenced specifications shall be subject to the acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

2.2 Submittals.

a. All equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed when directed by the Engineer and replaced with materials that do comply with these specifications at the sole cost of the Contractor.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Materials or equipment purchased prior to Engineer approval and are rejected for any reason, shall be removed and replaced at the Contractor's expense. No additional compensation will be provided. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment or options and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be bold and clearly made with arrows or circles. Highlighting is not acceptable and is means for rejection. Contactor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures, which in the Engineer's opinion, does not meet the system design and the standards and codes specified herein.

2.3 Fiber Optic Cable.

a. Performance Requirements. Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard. Pathways and spaces shall comply with TIA/EIA-569-A. Grounding shall comply with ANSI-J-STD-607-A. All electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Cable support shall be NRTL labeled for support for fiber optic cable, designed to prevent degradation of cable performance and pinch points that could damage cable. Support brackets with cable tie slots for fastening cable ties to brackets. Cable ties shall only be "Velcro" type. Lacing bars, spools, bridal rings, and D-rings. J-hooks shall not be used.

b. Shop Drawings. Shop drawings shall include Manufacturer's data covering all products proposed indicating construction, materials, ratings, and all other parameters identified below.

c. Qualification Data. For Installer, qualified layout technician, installation supervisor, and field inspector.

1. Cabling Installer must have personnel certified by BICSI on staff.

2. Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this bid item is performed at the Project site.

3. The Testing Supervisor shall be currently certified by BICSI as an RCDD to supervise onsite testing.

d. Product.

1. General Requirements.

a. Refer to drawings for cross-section fiber counts.

b. All fiber strands within cable shall be individually color jacketed.

c. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification. Factory optical fiber splices are not allowed.

d. All fibers shall have been subjected to a minimum tensile proof test by the fiber manufacturer equivalent to 100-kpsi.

e. All fibers in each cable shall be guaranteed to meet the stated specifications.

2. Single Mode FOC Requirements.

a. Fiber type: single mode, doped silica core surrounded by a concentric glass cladding.

b. Core Diameter: 8-9 microns. All fiber shall be of the same nominal core diameter and profile.

c. Cladding diameter shall be 125 ±1.0 microns.

d. Cladding non-circularity shall be ≤ 0.8 microns.

e. Fiber coating diameter shall be 250 ±15 microns (primary coating) and 900 microns (secondary coating) nominal. All coatings shall be mechanically strippable without damaging the optical fiber.

f. Cutoff wavelength shall be ≤ 1260 nm.

g. Mode field diameter shall be 8.3-9.8 nm @ 1300 nm and 10.5 ±1.0 microns at 1550 nm.

h. Zero dispersion wavelength shall be between 1301.5 nm and 1321.5 nm.

i. Zero dispersion slope shall be ≤ 0.092 ps/nm2-km.

j. Maximum attenuation @ 1300 nm and 1550 nm shall be 0.5 dB/km when tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical cable, and Other Passive Fiber Optics Components", the average change in attenuation over the rated temperature range of the cable shall not exceed 0.05 dB/km at 1550 nm for single mode fiber. The magnitude of the maximum attenuation change of each individual fiber shall not be greater than 0.15 dB/km at 1550 nm.

k. Fiber dispersion (maximum) for 1285 – 1330 nm shall be 3.2 ps/nm-km and for 1550 nm, shall be 18 ps/nm-km. No single mode optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that fiber by the Owner.

l. Fiber optic cable shall comply with ITU-T G.652.D.

3. Indoor/Outdoor Cable Requirements.

a. Plenum rated fiber optic cable shall be suitable for indoor and outdoor applications, including installation in underground ducts, in building riser systems, in conduit, in cable tray, and in innerduct. Cable shall have the following features:

1. Cable shall carry an NFPA 70 OFNP rating (Optical Fiber Non-conductive Plenum).

2. Cable shall be tight bound, tight buffered design.

3. Indoor/Outdoor fiber shall be yellow in color.

4. Cable materials shall be all dielectric (no conductive materials).

5. Jacket for indoor/outdoor cable shall be high temperature plenum fluoropolymer. The outer sheath shall be marked with the manufacturer's name, words identifying the cable type, year of manufacture, and sequential length markings. The marking shall be in a contrasting color to the cable jacket.

6. The cable jacket shall be listed for: duct installation, fungus resistant, UV resistant, water resistant, direct burial, high flex life, low friction, and petrochemical resistant.

7. Operating and storage temperature for indoor/outdoor cable shall be -40 deg. C to +85 deg. C. Installation temperature shall be -10 deg. C to +60 deg. C (actual cable temperature).

8. Minimum bend radius under installation tensile load and long-term tensile load shall be 15x outside diameter.

9. Crush resistance shall be maximum 1500N/cm. Impact resistance shall be maximum 1000 impacts. Flex resistance shall be a maximum 1000 cycles.

10. Maximum tensile strength during installation shall be 1400 N for 4-8 strand fibers, 2700 N for 12-18 strand fibers, and 3000 for 24-36 strand fibers.

11. Maximum tensile strength long-term shall not exceed 890 N.

4. Cable Connector/Terminations.

a. The optical connector shall be as required to meet network system and fiber optic transceiver equipment requirements.

b. The connector ferrule shall be ceramic or glass-in-ceramic, metallic, or equivalent. The optical fiber within the connector ferrule shall be secured with an adhesive or mechanical process to prevent pistoning and other movement of the fiber strand.

c. The connectors shall be Type SC.

d. The connector body shall be of metal or composite material.

e. The attenuation per mated pair shall not exceed the following values: 0.5 dB (individual) and 0.3 dB (average). These values shall hold throughout the cable system. Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.

f. The connector shall meet the following performance criteria: 0.2 dB for cable retention (FOTP-6), mating durability (FOTP-21), impact (FOTP-2), thermal shock (FOTP-3), and humidity (FOTP-5).

g. The connector end-face finish shall be a high performance, spherically ultra-polished design.

h. Reflectance shall be -55 dB or better when mated with a patch-cord made up of connectors of comparable design.

5. Cable Straps.

a. All fiber optic cables installed within racks or cabinets shall be fitted with multiuse cable straps for cable management within racks and cabinets.

b. Velcro type wire and cable stapes to provide easy access for servicing of cable.

c. Velcro One-Wrap Lite Cable Wraps (Black Box Item number FT380) or approved equivalent.

3. CONSTRUCTION METHODS

3.1 General. The Contractor shall install the specified fiber optic cable in the conduit at the approximate locations indicated on the layout plans. The Engineer shall indicate specific locations. Fiber optic cable connections, splices and terminations will be permitted only at locations called for on the plans. Contractor shall be responsible for providing cable in continuous lengths for long runs without splices, unless authorized in writing by the Engineer or shown on the Plans.

This item includes the installation of the cable in conduit or duct as described below. The maximum number of cables installed in each single conduit shall be in accordance with the latest National Electric Code, or the code of the local agency having jurisdiction. The Contractor shall make no splices of any kind in cables installed in conduits or ducts.

It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

Beginning installation means the Contractor accepts existing conditions. The Contractor will be responsible for identifying and reporting to the Site Coordinator(s) any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway or other hardware must be repaired by the Contractor. Repairs must match preexisting color and finish of walls, floors, and ceilings. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction Supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

Qualified personal utilizing state of the art equipment and techniques shall complete all installation work. During pulling operations, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

Should it be found by the Engineer that the materials or any portion thereof, furnished and installed under this contract, fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced at sole expense of the Contractor.

The Contractor shall make sure that the entire conduit/duct is open, continuous, and clear of debris before installing cable. The cable shall be installed in a manner to prevent harmful stretching or kinking of the cable or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape before pulling into the conduit and shall be left sealed until the connections are made. Where more than one cable is to be installed in a duct under the same contract, all cables shall be pulled in the 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. Pulling tensions should be governed by recommended standard

practice for straight pulls or bends. A lubricant recommended for the type of cable being installed should be used were pulling lubricant is required.

3.2 Conduit. Conduit shall be installed in accordance with Item L-110, “Installation of Airport Underground Electrical Duct”. Install manufactured conduit sweeps and long radius elbows whenever possible.

3.3 Handholes. Handholes shall be installed in accordance with Item L-115, “Electrical Handholes and Junction Structures". Comply with TIA/EIA-569-A for pull box installations. All handholes installed for the fiber optic run shall be of the lockable design.

3.4 Directional Boring. Directional boring shall be completed in accordance with Item D555 “Directional Boring”.

3.5 Splicing. Where shown on the Plans, the splicing of optical fibers shall use the fusion method with the individual splice loss not to exceed 0.1 dB. Secure cables in enclosure per manufacturer’s recommended procedures. A separate splice tray shall be used for each fiber bundle/cable. Splice enclosure shall be sealed as to be re-enterable. Do not encapsulate. Splices shall not be below final grade.

3.7 Fiber Optic Cable. General requirements for cable installation:

a. Comply with TIA/EIA-586-B.1 and TIA/EIA-586-B.3.

b. Comply with BICSI ITSIM, Chap 6, “Cable Termination Practices”.

c. Terminate all conductors. No cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects and patch panels.

d. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, frames, and terminals.

e. Install lacing bars to restrain cables to prevent straining connections and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

f. Do not install bruised, kinked, scored, deformed or abraded cable. Do not splice cable between termination, tap or junction points. Remove and discard cable if damaged during installation and replace with new cable.

g. For cold weather installation, bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

h. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include but not limited to sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.

i. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to insure that the maximum tensile load for the cable

as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break-away” or other approved method.

j. Cable pulling shall be done in accordance with the cable manufacturer’s recommendations and ANSI/IEEE C2 standards. Manufacturer’s recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bend radius shall not be exceeded. Any cable bent or kinked to radius less than recommended shall be replaced by the Contractor with no addition cost to the Project.

k. Avoid abrasion and other damage to the cables during installation.

l. The cable system shall be tested and documented upon completion of the installation as defined below.

m. A pull cord (nylon 1/8” minimum) shall be co-installed with all cable installed in any indoor conduit. A pull cord (nylon ¼” minimum) shall be co-installed with all cable installed in any underground conduit.

n. Install #10 XLP copper wire (tracer wire) through entire outdoor underground route.

3.7 Fiber Optic Cable Terminations. All fibers shall be terminated with SC connectors. Fibers shall be positioned consecutively and mapped “position for position” between patch panels. There shall be no transpositions in the cabling. Connectors from two cables shall never share a common coupling panel. Multi-mode and single mode optical fibers shall be segregated on the panels as to clearly identify the distinction between the fiber types. All terminated fibers at the IDF’s shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing. All couplings shall be fitted with a dust cap. Fibers from multiple locations may share a common enclosure, however, they must be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure provided they are clearly identified as such. Fibers from different locations shall not share a common connector panel (or insert). Slack in each fiber shall be provided as to allow future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of 3 foot of slack shall be retained regardless of panel position relative to the potential work area.

3.8 Quality Control. The Contractor shall engage a qualified testing agency to perform tests and inspections. The Contractor is responsible to perform acceptance tests as indicated below for each sub-system as it is completed. All tests shall be documented. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type including equipment to be used, set-up, test frequencies or wavelengths, results format, etc. The method of testing shall be approved by the Engineer. The Contractor shall visually inspect all cabling and termination points to insure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Engineer with a written certification that this inspection has been made. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Owner. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Engineer as to allow for such participation. The notification shall include a written description of the proposed conduct of the tests including copies of blank test result sheets to be used.

IMPORTANT: Failure to provide the above information shall be grounds for the Owner/Engineer to reject any

and all documentation of results on related testing and to require a repeat of the affected test.

Tests related to connected equipment of others shall only be done with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct. The Contractor shall provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Engineer, the Contractor shall provide copies of the original tests results. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated. Should it be found by the Engineer that the materials or any portion thereof furnished and install under this contract fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all work distributed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contactor's expense.

3.9 Tests and Inspections. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communication equipment rooms for compliance with color coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the Contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include 1) manufacturer's on the reel attenuation test results at the specified wavelengths for each optical fiber of each reel prior to shipment from the manufacturer and 2) on the reel bandwidth performance as tested at the factory.

Upon completion of cable installation and termination, the fiber optic cabling shall be tested to include Optical Attenuation ("Insertion Loss" Method) and Verification of Link Integrity (OTDR).

a. Optical Attenuation Testing. Optical Attenuation testing shall be measured on all terminated optical fibers in both directions of transmission using the "Insertion Loss" Method. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints. 100 foot access jumpers shall be used at both the transmit and receive ends to insure that an accurate measurement of connector losses is made. Single mode fibers shall be tested in accordance with the EIA/TIA 526-7-1998 Method A.1. Testing shall be at 1300 ± 20 nm. Attenuation of optical fibers shall not exceed the values calculated as follows:

Attenuation (max) = 2*C + L*F +S dB, where C is the maximum allowable connector loss (dB), L is the length of the run (km), F is the maximum allowable fiber loss (dB/km) and S is the total splice loss (# of splices * max attenuation per splice).

b. OTDR Testing. All fibers, even those that are left un-terminated, shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Single mode fibers shall be tested at 1300 nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. OTDR traces revealing a point discontinuity greater than 0.1 dB in a single mode fiber at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of the fiber by the Owner. The installation of that cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that cable and the associated terminations shall be replaced at the expense of the Contractor.

Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration. Link End to End Attenuation tests: Horizontal backbone link measurements test at 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper. Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less that that calculated according to equation in TIA/EIA-568-B.1.

Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

Remove and replace cabling where test results indicate that they do not comply with specified requirements.

End to end cabling will be considered defective if it does not pass tests and inspections.

Contractor shall prepare test and inspection reports.

4. METHOD OF MEASUREMENT

4.1 The quantity of single mode fiber optic cable (6 strand) installed in conduit, duct, or cable tray to be paid for shall be the number of linear feet of cable installed, measured in place, completed, ready for operation, and accepted as satisfactory. Measurement for the purpose of payment shall be the center to center distance from handhole to handhole or termination point. Additional cable slack at handholes and termination ends shall be incidental to the bid item.

4.2 The quantity of core drilling into existing handhole shall be measured per lump sum. This is measured for complete entrance into the handhole, including all excavation and restoration to set-up and core into the handhole.

5. BASIS OF PAYMENT

5.1 Payment for new 6-strand single mode fiber optic cable installed, measured as provided above, shall be made at the contract unit price per linear foot. This price shall be full compensation for all materials, equipment, tools, labor and other incidentals necessary to complete the work including but not limited to terminations and testing.

5.2 Payment for coring into existing handhole, measured as provided above, shall be made at the contract unit price per each. This price shall be full compensation for all materials, equipment, tools, labor and other incidentals necessary to complete the work.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-152-5.1	New 6-Strand SM FOC, Installed	-per linear foot
L-152-5.2	Core into Existing Handhole	-per lump sum

END OF SECTION ITEM L-152 FIBER OPTIC CABLE.

ITEM L-155 EQUIPMENT RACK

1. DESCRIPTION

1.1 Scope of Work. The work specified in this section shall include the installation of an equipment rack as shown on the plans. This work includes new grounding system, handholes, conduit, foundation, and equipment enclosures. Along with an utility approved meter socket and disconnect switch.

The Contractor shall coordinate with the Airport and Johnson Controls, Inc. before work begins to coordinate and minimize the down time to existing systems.

2. EQUIPMENT AND MATERIALS

2.1 General. All equipment and materials covered by referenced specifications shall be subject to the acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

2.2 Submittals.

a. All equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed when directed by the Engineer and replaced with materials that do comply with these specifications at the sole cost of the Contractor.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Materials or equipment purchased prior to Engineer approval and are rejected for any reason, shall be removed and replaced at the Contractor's expense. No additional compensation will be provided. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment or options and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be bold and clearly made with arrows or circles. Highlighting is not acceptable and is means for rejection. Contactor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures, which in the Engineer's opinion, does not meet the system design and the standards and codes specified herein.

2.3 Equipment Rack. The equipment rack shall have 2" uni-strut cross members mounted to 3" galvanized pipe embedded in concrete.

2.4 Equipment Enclosures. The equipment enclosure shall be NEMA 3R rated, lockable,gasket, and sized to accommodate the enclosed equipment. The Contractor shall verify all equipment prior to furnishing enclosures.

2.5 Disconnect Switch. The disconnect switch shall be NEMA 3R, heavy duty rated disconnect fused at 200 amps, and 600 volts. The disconnect switch shall be rated for service entrance.

2.6 Meter Socket. The meter socket shall be a utility approved meter socket for underground single phase 120/240 volt, 200 amp service.

2.7 Concrete. Concrete shall conform to Item P-610, Structural Portland Cement Concrete, and using 1-inch maximum size coarse aggregate with a minimum 28 day compressive strength of 4000 psi. Where reinforcement is specified, reinforcing steel shall conform to ASTM A 615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

2.8 Conduit. Conduit shall conform to Item L-110, Underground Electrical Conduits and Ducts, ad sized as shown on the Plans. Conduits shall be incidental to the respective pay item of which they are a component part.

2.9 Cables. Cables shall conform to Item L-108, Installation of Underground Cable, and Item L-152, Fiber Optic Cable, with quantity and size as shown on the Plans. Unless specified, the minimum wire size shall be #10 AWG. Insulation shall be THWN unless otherwise specified on the Plans.

2.10 Ground Ring. The ground ring shall consist of (3) – 3/4" by 10' long copper clad steel ground rods a minimum 10' apart, connected by exothermic welds to a #2 AWG bare copper cable. The grounding cable shall be a #2 AWG, 600V THWN cable and connect the grounding ring to the power panel.

2.11 Power Panel. The power panel shall be NEMA 3R rated, three phase – four wire, 120/208 volt and a 200A main breaker. The copper bus shall be rated for 225 amps. The panel shall include a copper neutral and grounding bars. The circuit breakers shall be sized as shown on the Plans. The molded case circuit breakers shall be thermal-magnetic, inverse time-current for low level overloads and instantaneous magnetic trip element for short circuits.

2.12 Communication Equipment. The communication equipment to be mounted in the communication enclosure shall include, but not be limited to, CK721 module, RDR2S module, an Ethernet switch, and power supply with battery backup. The Contractor shall coordinate with Johnson Controls, Inc. for final communication equipment list and placement within the enclosure.

3. CONSTRUCTION METHODS

3.1 General. The Contractor shall install the equipment rack at the approximate location indicated on the layout plans. The Engineer shall indicate specific locations. Once the rack is in place, securely install the enclosures, meter and disconnect switch to the equipment rack. Do not install other equipment or cables until all the conduit/duct system is installed and ready for cable pulls. Clean the conduit/duct system as described in L-110, then install the rest of the equipment in the enclosures.

Fiber optic and power cable connections, splices and terminations will be permitted only at locations called for on the plans. The Contractor shall be responsible for providing cable in continuous lengths for long runs without splices, unless authorized in writing by the Engineer or shown on the Plans. The maximum number of cables installed in each single conduit shall be in accordance with the latest National Electric Code, or the code of the local agency having jurisdiction. The Contractor shall make no splices of any kind in cables installed in conduits or ducts.

It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

Qualified personal utilizing state of the art equipment and techniques shall complete all installation work. During pulling operations, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

Should it be found by the Engineer that the materials or any portion thereof, furnished and installed under this contract, fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced at sole expense of the Contractor.

4. METHOD OF MEASUREMENT

4.1 The equipment rack shall be measured as a lump sum. This shall include all cable, conduit, connections, terminations, power and communication equipment, grounding, foundations, restoration, handholes and other incidentals installed, measured in place, completed, ready for operation, and accepted as satisfactory.

5. BASIS OF PAYMENT

5.1 Payment for new equipment rack installed, measured as provided above, shall be made at the contract unit price per lump sum. This price shall be full compensation for all materials, equipment, tools, labor and other incidentals necessary to complete the work including but not limited to terminations and testing.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-155-5.1	New Equipment Rack, Installed	-per lump sum

END OF SECTION ITEM L-155 EQUIPMENT RACK

ITEM L-156 LOCKABLE HANDHOLE

1. DESCRIPTION

1.1 Scope of Work. The work specified in this section shall include the installation of gate access equipment not covered under other specifications. These items shall include the card readers, area lighting, a security camera and concrete island around the card readers. These items will be paid for as separate items to be included in the overall security gate installation.

The Contractor shall coordinate with the Airport and Johnson Controls, Inc. before work begins to coordinate and minimize the down time to existing systems.

2. EQUIPMENT AND MATERIALS

2.1 General. All equipment and materials covered by referenced specifications shall be subject to the acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

2.2 Submittals.

a. All equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed when directed by the Engineer and replaced with materials that do comply with these specifications at the sole cost of the Contractor.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Materials or equipment purchased prior to Engineer approval and are rejected for any reason, shall be removed and replaced at the Contractor's expense. No additional compensation will be provided. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment or options and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be bold and clearly made with arrows or circles. Highlighting is not acceptable and is means for rejection. Contactor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures, which in the Engineer's opinion, does not meet the system design and the standards and codes specified herein.

2.3 Card Reader. The card reader shall be similar to HID RPK 40 card readers or Engineer approved equal.

2.4 Security Camera. The security camera shall be AXIS Q6032-E PTZ dome network camera, or Engineer approved equal.

2.5 Area Lighting. The area lighting shall be 60W metal halide fixture mounted on a pole. The fixture shall be powered from a 120V circuit.

2.6 Poles. The poles for area lighting shall be 4 inch square straight steel poles, shall be 10 feet in height and have a minimum wall thickness of 0.125 inch. The poles for security cameras shall be 6 inch square straight steel poles, shall be 20 feet in height and have a minimum wall thickness of 0.18 inch. All poles shall have a black powder coat finish.

2.7 Concrete. Concrete shall conform to Item P-610, Structural Portland Cement Concrete, and using 1-inch maximum size coarse aggregate with a minimum 28 day compressive strength of 4000 psi. Where reinforcement is specified, reinforcing steel shall conform to ASTM A 615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

2.8 Conduit. Conduit shall conform to Item L-110, Underground Electrical Conduits and Ducts, ad sized as shown on the Plans. Conduits shall be incidental to the respective pay item of which they are a component part.

2.9 Cables. Cables shall conform to Item L-108, Installation of Underground Cable, and Item L-152, Fiber Optic Cable, with quantity and size as shown on the Plans. Unless specified, the minimum wire size shall be #10 AWG. Insulation shall be THWN unless otherwise specified on the Plans.

3. CONSTRUCTION METHODS

3.1 General. The Contractor shall install the security camera, card readers and area lighting at the approximate locations indicated on the layout plans. The Engineer shall indicate specific locations. Do not install cables until all the conduit/duct system is installed and ready for cable pulls. Clean the conduit/duct system as described in L-110 prior to cable pulls.

The Contractor shall coordinate with Johnson Controls, Inc. during installations. The Contractor shall be responsible for providing cable in continuous lengths for long runs without splices, unless authorized in writing by the Engineer or shown on the Plans. The maximum number of cables installed in each single conduit shall be in accordance with the latest National Electric Code, or the code of the local agency having jurisdiction. The Contractor shall make no splices of any kind in cables installed in conduits or ducts.

It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

Should it be found by the Engineer that the materials or any portion thereof, furnished and installed under this contract, fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced at sole expense of the Contractor.

4. METHOD OF MEASUREMENT

4.1 The card reader and concrete island shall be measured as a lump sum. This shall include all cable, conduit, connections, terminations, and communication equipment, grounding, foundations, restoration, handholes and other incidentals installed, measured in place, completed, ready for operation, and accepted as satisfactory.

4.2 The area lighting item shall be measured as per each. This shall include all cable, conduit, connections, terminations, fixture, pole, anchor bolts, fuses, grounding, foundations, restoration, and other incidentals installed, measured in place, completed, ready for operation, and accepted as satisfactory.

4.3 The security camera item shall be measured as per each. This shall include all cable, conduit, connections, terminations, camera, pole, anchor bolts, fuses, grounding, foundations, restoration, and other incidentals installed, measured in place, completed, ready for operation, and accepted as satisfactory.

5. BASIS OF PAYMENT

5.1 Payment for new card readers installed, measured as provided above, shall be made at the contract unit price per lump sum. This price shall be full compensation for all materials, equipment, tools, labor and other incidentals necessary to complete the work including but not limited to terminations and coordination with Johnson Controls, Inc.

5.2 Payment for area lighting installed, measured as provided above, shall be made at the contract unit price per each. This price shall be full compensation for all materials, equipment, tools, labor and other incidentals necessary to complete the work including but not limited to terminations and fixture adjustments.

5.3 Payment for new security camera installed, measured as provided above, shall be made at the contract unit price per lump sum. This price shall be full compensation for all materials, equipment, tools, labor and other incidentals necessary to complete the work including but not limited to terminations and coordination with Johnson Controls, Inc.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-156-5.1	Card Reader Island, Installed	-per lump sum
L-156-5.2	Area Lighting, Installed	-per each
L-156-5.3	Security Camera, Installed	-per lump sum

END OF SECTION L-156 GATE ACCESS CONTROL

ITEM L-157 RTR CABLE

1. DESCRIPTION

1.1 This item shall consist of underground communication cable, furnished and installed in accordance with this specification at the locations and in accordance with the design, dimensions, and details shown on the Plans. This item shall include the installation of cable and counterpoise wire in duct or conduit. It shall include terminating, cable marking, and testing of the installation and all incidentals necessary to place the communication cable in operating condition as a completed unit, to the satisfaction of the Engineer and local FAA. This item shall also include the removal and disposal of the existing communication cable as shown on the Plans.

2. EQUIPMENT AND MATERIALS

2.1 General.

(a) Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20591, and shall be listed in Advisory Circular 150/5345-1, Approved Airport Equipment.

(b) All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.

(c) Contractor shall submit shop drawings of the communication cable to the Engineer for approval prior to procurement. The shop drawings shall contain the original manufacturer’s cut sheet with all pertinent information clearly marked or labeled. Highlighting is not acceptable. Copies of cut sheets will be accepted as long as they are as good as the originals. Unclear markings, or unreadable submittals shall be cause for rejection.

2.2 Communication Cable. Underground cable shall conform to the requirements of FAA-GL-918C, Division 16E, Control Cable.

The conductors shall be #19 AWG solid annealed copper. The conductor installation shall be solid polypropylene or polyethylene, color coded in accordance with telephone industry standard coding. Individual conductors shall be twisted into pairs with varying lays to minimize crosstalk. The 25 pairs shall be assembled into a single cylindrical group. Water resistant, non-hardening compound shall fill and seal all interstices between the conductor pairs. The core covering shall be non-hygroscopic dielectric tape. Water resistant and bonding compound shall fill all voids between the core wrap and shield, and between the shield and jacket. The shield shall be corrugated, electrically continuous and longitudinally applied coated aluminum (0.008 inch) or copper (0.005 inch). The jacket shall be high molecular weight polyethylene or ethylene copolymer. The cable shall be constructed to be gopher resistant. The cable shall be marked at regular intervals with the cable manufacturer, manufacture date, number of pairs, conductor gauge, sequential length marks, and gopher resistant shield shall be clearly mark. The cable shall be manufactured within 1 calendar year of installation. Prior to installation, the cable shall be protected. The cable ends shall be

wrapped and protected from moisture.

Cable shall be a 25 pair, #19 shielded communication cable. There shall be 4 of these cables per the length of the cable run as shown on the Plans.

2.3 Bare Copper Wire (Counterpoise). #1/0 bare copper wire for counterpoise installations shall be stranded wire conforming to ASTM Specifications B3 and B8.

3. CONSTRUCTION METHODS

3.1 General. The Contractor shall install the specified cable, in conduit, at the approximate locations indicated in the Plans. The Engineer shall indicate specific locations.

The Contractor shall be responsible for providing cable in continuous lengths for long cable runs without splices, unless otherwise authorized in writing by the Engineer or shown on the plans.

3.2 Installation in Duct or Conduit. 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 shall be in accordance with the latest National Electric Code, or the code of the local agency having jurisdiction. The Contractor shall make no connections or joints of any kind in cables installed in conduits or ducts.

The duct or conduit shall be installed as a separate item in accordance with Item L-110, "Installation of Airport Underground Electrical Duct." This shall include all trenching and restoration to install the conduit/duct. The Contractor shall make sure that the duct is open, continuous, and clear of debris before installing cable. The cable shall 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 shall be sealed with moisture-seal tape before pulling into the conduit and it shall be left sealed until connections are made. Connections shall be made by the Contractor with the guidance and supervision of the local FAA. Where more than one cable is to be installed in a duct under the same contract, all cables shall be pulled in the 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. Pulling tensions should be governed by recommended standard practices for straight pulls or bends. A lubricant recommended for the type of cable being installed should be used where pulling lubricant is required. Duct or conduit markers temporarily removed for excavations shall be replaced as required.

Cables shall not be installed until the entire duct has been installed and ready for operation.

3.3 Splicing. Splicing is not allowed. Any cut, damage or faulty cable shall be replaced with entirely new cable.

3.4 Bare Counterpoise Wire Installation and Grounding for Lightning Protection. If shown on the plans or specified in job specifications, a stranded bare copper wire, No. 1/0 AWG minimum size, shall be installed for lightning protection of the underground cables. The bare counterpoise wire shall be installed for the entire length of the insulated cable it is designed to

protect, and shall be placed above the concrete encase duct in the same trench as the duct. The counterpoise wire shall be securely attached to copper or copper-clad ground rods installed not more than 90 feet apart (plus or minus 20%) around the entire circuit and at the beginning and end of each counterpoise circuit. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 10-feet long nor less than 3/4 inch in diameter. The tops of the ground rods shall be installed 10-inches below grade.

The counterpoise system shall terminate at the existing handhold's counterpoise system. These systems shall be connected as one. Ground rods shall be incidental to the counterpoise bid item.

3.5 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the underground cable circuits after installation. The Contractor shall test and demonstrate to the satisfaction of the Engineer and the local FAA the following:

(a) That all control circuits are continuous and free from short circuits.

(b) That all circuits are free from unspecified grounds.

(c) That the insulation resistance to ground of all circuits is not less than 50 megohms.

(d) That the insulation resistance to ground of all non-grounded conductors of multiple circuits is not less than 50 megohms.

(e) That all circuits are properly connected in accordance with applicable wiring diagrams and accepted by the local FAA.

(f) That all circuits are operable and any tests as directed by local FAA.

4. METHOD OF MEASUREMENT

4.1 The quantity of cable or counterpoise wire installed in conduit or duct to be paid for shall be the number of linear feet of cable or counterpoise wire installed, measured in place, completed, ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable type or counterpoise wire installed. Cable terminations shall be incidental to the cable bid item. Ground rods shall be incidental to counterpoise bid item.

4.2 Measurement for the purposes of payment shall be the center to center distance from handhole to handhole or structure penetration (termination point) as the case may be, along the path of the conduit in which the cable is installed. An additional THREE (3) feet of cable will be allowed at each termination point and THIRTY (30) feet of cable allowed at each handhole to provide for the required cable slack at those locations. The cable slack shall be incidental to the cable installation. The measurement for the (4) 25 pair cable will be measured as stated, then multiplied by 4 to get the four cables paid for.

4.3 Measurement for payment will be made for cable removal in conduit or duct as shown on the plans and as directed by the Airport Engineer. Measurement for the purposes of payment shall be as described in paragraph 4.2 above.

5. BASIS OF PAYMENT

5.1 Payment will be made at the contract unit price for cable, and bare counterpoise wire installed in trench, conduit, or duct, by the Contractor and accepted by the Engineer. Any trenching or plowing required for cable or counterpoise shall be incidental to the respective pay item. Ground rods shall be incidental to the counterpoise.

5.2 Payment will be made at the contract unit price for the removal of cabling in existing lighting ductwork or conduit. This price shall be full compensation for furnishing all materials and for all preparation, installation, maintenance and removal of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
L-153-5.1	25 Pair #19 Shielded Control Cable, in Duct	- per Linear Foot
L-153-5.2	#1/0, Bare Copper Counterpoise Wire	- per Linear Foot
L-153-5.3	Removal of Existing (4)25 Pair Control Cable	- per Linear Foot

END OF SECTION L-157 RTR CABLE

ITEM P-610 PORTLAND CEMENT CONCRETE

1. DESCRIPTION

610-1.1 This item shall consist of reinforced structural Portland cement concrete, prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans.

2. MATERIALS

610-2.1 GENERAL. Only approved materials, conforming to the requirements of these specifications, shall 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 shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be scored and handled to insure the preservation of their quality and fitness for use and shall 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.

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall 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.

Aggregates shall be tested for deleterious reactivity with alkalies in the cement that may cause excessive expansion of the concrete. Acceptance of aggregates shall be based upon satisfactory evidence furnished by the Contractor that the aggregates, combined with other mixture constituents, do not produce excessive expansion in the concrete. This evidence shall include service records of concrete of comparable properties under similar conditions or exposure and certified records of tests by a testing laboratory that meets the requirements of ASTM C 1077. Tests shall be made in accordance with ASTM C 1260. Test specimens shall be produced using all components (e.g. coarse aggregate, fine aggregate, cement and fly ash…) to be included in the produced concrete. If the mean expansion of the test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting the aggregates shall be accepted. If the mean expansion at 16 days is greater than 0.10% but less than 0.15%, the aggregate may be accepted based upon satisfactory service records and acceptance of the aggregate by a State Highway Department specifically addressing Alkali-Silica Reactivity. If the expansion is greater than 0.15%, the aggregate shall not be accepted for use.

610-2.2 COARSE AGGREGATE. The coarse aggregate for concrete shall meet the requirements of ASTM C 33. Crushed stone aggregate shall have a durability factor, as determined by ASTM C 666, greater than or equal to 95. The Engineer may consider and reserve final approval of other State classification procedures addressing aggregate durability.

Coarse aggregate shall be well graded from coarse to fine and shall meet one of the gradations shown in Table 1, using ASTM C 136.

610-2.3 FINE AGGREGATE. The fine aggregate for concrete shall meet the requirements of ASTM C 33.

The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of Table 2 when tested in accordance with ASTM C 136:

TABLE 1. GRADATION FOR COARSE AGGREGATE

Sieve Designation (square openings)	Percentage by Weight Passing Sieves						
	2”	1-1/2”	1”	3/4"	1/2"	3/8"	No.4
No. 4 to 3/4 in. (4.75-19.0 mm)			100	90-100		20-55	0-10
No. 4 to 1 in. (4.75-25.0 mm)		100	90-100		25-60		0-10
No. 4 to 1-1/2 in. (4.75-38.1 mm)	100	95-100		35-70		10-30	0-5

TABLE 2. GRADATION FOR FINE AGGREGATE

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
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

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 610-2.6 on admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

610-2.4 CEMENT. Cement shall conform to the requirements of ASTM C 150, Type 1A. The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before permission to use the cement is granted. All such test reports shall be subject to verification by testing sample materials received for use on the project.

610-2.5 WATER. The water used in concrete shall be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

610-2.6 ADMIXTURES. The use of any material added to the concrete mix shall be approved by the Engineer. Before approval of any material, the Contractor shall be required to submit the results of complete

physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests shall be made of samples taken by the Engineer 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 approved.

Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolons meeting the requirements of ASTM C 618.

Air-entraining admixtures shall meet the requirements of ASTM C 260. Air-entraining admixtures shall be added at the mixer in the amount necessary to produce the specified air content.

Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

610-2.7 PREMOLDED JOINT MATERIAL. Premolded joint material for expansion joints shall meet the requirements of ASTM 1751.

610-2.8 JOINT FILLER. The filler for joints shall meet the requirements of Item JS-1, unless otherwise specified in the proposal.

610-2.9 STEEL REINFORCEMENT. Reinforcing shall consist of deformed bars of Grade 60 billet steel, conforming to the requirements of ASTM A 615.

610-2.10 COVER MATERIALS FOR CURING. Curing materials shall conform to one of the following specifications:

Waterproof paper for curing concrete	ASTM C 171
Polyethylene Sheeting for Curing Concrete	ASTM C 171
Liquid Membrane-Forming Compounds for Curing Concrete	ASTM C 309, Type 2

3. CONSTRUCTION METHODS

610-3.1 GENERAL. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, 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 proposes to use on the work, shall be of sufficient size to meet the requirements of the work, and shall be such as to produce satisfactory work; all work shall be subject to the inspection and approval of the Engineer.

610-3.2 CONCRETE COMPOSITION. The concrete shall develop a compressive strength of 4,000 psi in 28 days as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete shall contain not less than 470 pounds of cement per cubic yard (280 kg per cubic meter). The concrete shall contain 5 percent of entrained air, plus or minus 1 percent, as determined by ASTM C 231 and shall have a slump of not more than 4 inches (10 cm) as determined by ASTM C 143.

610-3.3 ACCEPTANCE SAMPLING AND TESTING. Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 3.2. The concrete shall be sampled in accordance with ASTM C 172. Compressive strength specimens shall be made in accordance with ASTM C 31 and tested

in accordance with ASTM C 39.

Concrete cylindrical test specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The Contractor shall cure and store the test specimens under such conditions as directed. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

610-3.4 PROPORTIONING AND MEASURING DEVICES. When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be approved by the Engineer and shall 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.

610-3.5 CONSISTENCY. The consistency of the concrete shall be checked by the slump test specified in ASTM C 143.

610-3.6 MIXING. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94.

610-3.7 MIXING CONDITIONS. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (4°C) without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his/her expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The delivery of concrete to the job shall be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

610-3.8 FORMS. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as designed on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor shall bear responsibility for their adequacy. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes.

The internal ties shall 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 shall be wetted with water or with a non-staining mineral oil, which shall be applied shortly before the concrete is placed. Forms shall be constructed so that they can be removed without injuring the concrete or concrete surface. The forms shall not be removed before the expiration of at least 30 hours from vertical faces, walls, slender columns, and similar structures; forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate that at least 60% of the design strength of the concrete has developed.

610-3.9 PLACING REINFORCEMENT. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The

reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.10 EMBEDDED ITEMS. Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.

610-3.11 PLACING CONCRETE. All concrete shall be placed during daylight, unless otherwise approved. The concrete shall 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 shall be placed as soon as practical after mixing and in no case later than 1 hour after water has been added to the mix. The method and manner of placing shall be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. Dropping the concrete a distance of more than 5 feet (1.5 m), or depositing a large quantity at one point, will not be permitted. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

The concrete shall be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators shall 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 shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Concrete deposited under water shall 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 shall not be disturbed after being deposited.

610-3.12 CONSTRUCTION JOINTS. When the placing of concrete is suspended, necessary provisions shall 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 shall be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete that has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

610-3.13 EXPANSION JOINTS. Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings. The premolded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.

610-3.14 DEFECTIVE WORK. Any defective work discovered after the forms have been removed shall 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 cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

610-3.15 SURFACE FINISH. All exposed concrete surfaces shall be true, smooth, and free from open or rough spaces, depressions, or projections. The concrete in horizontal plane surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

When directed, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall 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 shall be used to finish the surface. When approved, the finishing can be done with a rubbing machine.

610-3.16 CURING AND PROTECTION. All concrete shall be properly cured and protected by the Contractor. The work shall be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete shall be cured as soon as it has sufficiently hardened by covering with an approved material. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for a period of at least 3 days. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, they shall be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for 7 days after the concrete has been placed.

610-3.17 DRAINS OR DUCTS. Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

610-3.18 COLD WEATHER PROTECTION. When concrete is placed at temperatures below 40°F (4°C), the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated in order to place the concrete at temperatures between 50°F and 100°F (10°C and 38°C).

Calcium chloride may be incorporated in the mixing water when directed by the Engineer. Not more than 2 pounds (908 grams) of Type 1 nor more than 1.6 pounds (726 grams) of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall 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°F (10°C) until at least 60% of the designed strength has been attained.

610-3.19 FILLING JOINTS. All joints that require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools. Joint filling shall not be started until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

4. METHOD OF MEASUREMENT

610-4.1 Measurement for Portland cement concrete shall be made according to the respective pay items for which it will be used. No measurements or other allowances shall be made for reinforcing steel, forms, falsework, cofferdams, pumping, bracing, expansion joints, or finishing of the concrete.

610-4.2 Reinforcing steel shall be incidental to the Portland cement concrete measurement.

5. BASIS OF PAYMENT

610-5.1 Payment for this work shall be under the respective pay items for which the Structural Portland Cement Concrete will be used. The price for each respective pay item shall be full compensation for furnishing

all materials and for all preparation, delivery and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

TESTING REQUIREMENTS

ASTM C 31	Making and Curing Test Specimens in the Field
ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Slump of Hydraulic Cement Concrete
ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 666	Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 1077	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

MATERIAL REQUIREMENTS

ASTM A 184	Specification for Fabricated Deformed Steel Bar or Rod Mats for Concrete Reinforcement
ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 704	Welded Steel Plain Bars or Rod Mats for Concrete Reinforcement
ASTM C 33	Concrete Aggregates
ASTM C 94	Ready-Mixed Concrete
ASTM C 150	Portland Cement
ASTM C 171	Sheet Materials for Curing Concrete
ASTM C 172	Sampling Freshly Mixed Concrete
ASTM C 260	Air-Entraining Admixtures for Concrete

ASTM C 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Chemical Admixtures for Concrete
ASTM C 595	Blended Hydraulic Cements
ASTM C 618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM D 1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO T 26	Quality of Water to be Used in Concrete

END OF SECTION ITEM P-610 PORTLAND CEMENT CONCRETE

ITEM 323119 GATES OPERATOR

GENERAL

RELATED DOCUMENTS

The Federal Aviation Administration's Advisory Circular 150/5370-10F – Standards for Specifying Construction of Airports apply to this Section.

SUMMARY

This section shall consist of furnishing and installing box frame roller gate hydraulic operators in accordance with these specifications and the details shown on the Plans.

Includes all selected fence and gate attachments and accessory equipment including gate operators.

REFERENCES

Definitions:

1. ASTM: American Society for Testing and Materials International
2. American Welding Society
3. PVC: Polyvinyl chloride plastic
4. UL: Underwriters Laboratory Inc.

Reference Standards:

1. Gate operator shall be UL 325 listed.
2. All electrical work shall be completed according to local and National Electrical codes and all fieldwork shall be performed in a neat and professional manner.
3. Gate operators to be designed, labeled and compliant in all safety standard usage classes, Classes I-IV.

Quality Assurance

1. Manufacturer: A company specializing in fence, gates and operator manufacturing of the type specified, with a minimum of ten years experience.
2. Installer: a minimum of three years experience installing similar equipment.

SUBMITTALS

Certificates of Compliance:

1. Certificates of Compliance and other test or material information necessary to show compliance with these specifications fifteen (15) days prior to installation.
2. Provide manufacturer's catalog cuts with printed specifications and installation instructions.
3. Furnish detailed sequence of operation (description of system).

Shop Drawings and Manuals

1. Detailed shop drawings for each gate that includes gate fabrication assembly plans, operator access control equipment installation diagrams, wiring diagrams, and equipment lists. Clearly mark all options and equipment. Highlighting shall not be accepted.
2. Four (4) bound copies of the operating and service manuals for the equipment installed including name, address and telephone number of nearest fully equipped service center, prior to final payment.

Project Information

1. Test Reports: gate mechanism has been tested to 200,000 cycles without breakdown.

Warranty

Provide a five-year warranty against defects.

1. Replace defective materials
2. Include freight, labor, and other incidental costs.

PRODUCTS

GATE OPERATOR

1. Basis-of-design:
    a. “Slide Driver 30F-UPS (222 DX1.7 ST) with Smart Touch Controller” by HySecurity Gate Operators, or Engineer approved equal.
    b. Two controllers and UPSs per gate location.
    c. Operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 3000 pounds. Gate panel velocity shall not be less than 1.7 feet per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The “soft stop” feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction).
2. Standard mechanical components shall include as a minimum:
    a. Aluminum drive rails:
        1) Cast aluminum channel (sized for existing gate).
        2) Limit ramps as necessary
    b. Supporting arms:
        1) Cast aluminum channel.
        2) Arms shall incorporate a fully bushed, 1-1/2" bronze bearing surface.
        3) Arms shall act on arm pivot pins.
    c. Arm pivot pins:
        1) 3/4" diameter, stainless steel
        2) Integral tabs for ease of removal.
    d. Tension spring:
        1) 2-1/2" heavy duty.
        2) 800 pound capacity.
    e. Tension adjustment:
        1) Finger tightened nut, not requiring the use of tools.
    f. Drive release:
        1) Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
    g. Limit switches:

1) Fully adjustable, toggle type
2) Plug connection to control panel.

h. Electrical enclosure:
1) Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects.
2) Providing ample space for the addition of accessories.
3) Heater with thermostat control.

i. Chassis:
1) 1/4" steel base plate, and 12 Ga. sides and back - welded and ground smooth.

j. Cover:
1) 16 GA. galvanized sheet metal with a powder coat paint finish.
2) All joints welded, filled, and ground smooth.
3) Finished corners square and true with no visible joints.

k. Finish:
1) Fully zinc plated then finish coat of high gloss powder coat paint
2) Test proven to pass a 1,000-hour salt spray test.

l Drive wheels:
1) 6" Dia. Metal hub with polyurethane tread.

m. Drive rail:
1) Shall be extruded 6061 T6, not less than 1/8" thick.
2) Drive rail shall incorporate alignment pins for ease of replacement or splicing.
3) Pins shall enable a perfect butt splice.

n. Hydraulic hose:
1) Shall be 1/4" synthetic, rated to 2750 PSI.

o. Hydraulic valves:
1) Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.

p. Hose fittings:
1) At manifold: Quick-disconnect type.
2) Others: Swivel type.

q. Hydraulic fluid:
1) High viscosity index (greater than 375) type with temperature range of -40F to 167F.

r. Pressure gauge:
1) Zero to 2000 PSI dial
2) Mounted on the manifold for diagnostics, shall be a standard component.

s. The hydraulic fluid reservoir:
1) Formed from a single piece of metal, non-welded
2) Finish: Powder coat painted on the inside and the outside, to prevent fluid contamination.

3. Minimum standard electrical components:

a. Pump motor:

1) 2 HP, 56C, 24VDC motor

b. Motor Controller: DC Drive.

c. Operating voltage: 208VAC single phase (to UPS)

d. All components shall have overload protection.

e. Controls:

1) Smart Touch Controller Board with 256K memory containing:

a) Inherent entrapment sensor.

b) Built in “Warn before Operate” system.

c) Built in timer to close.

d) Liquid crystal display for system configuration and reporting of control status.

e) 26 programmable user relay output options.

f) Anti-tailgate mode.

g) Built-in power surge/lightning strike protection.

h) Menu configuration, event logging and system diagnostics are easily accessible with a PC and HySecurity’s free START software.

i) RS232 port for connection to laptop or other computer peripheral and RS485 for connection of Master/Slave systems.

f. Control circuit: 24VDC.

5. Required external sensors:

a. Devices which will cause closing gate or reverse its motion when the presence of an obstruction is sensed.

b. Type:

1) Gate edges with transmitter radio reversing device and in pavement vehicle loop detectors installed such that safe, reliable protection is ensured with both devices.

2) In pavement vehicle loop detectors to detect absence of vehicle for closing.

6. Uninterruptable Power Supply (Battery Cabinet)

a. 24V DC batteries serving as an uninterruptable power supply to ensure consistent operation if AC power fails.

b. Batteries:

1) Fully sealed lead acid maintenance-free batteries.

2) Battery power for a minimum of 3000’ feet of gate travel after AC power loss.

3) Batteries provided in a separate thermostatically controlled heated, insulated and ventilated enclosure. NEMAS 3R enclosure, pre- galvanized and painted to match controller cabinet.

c. Low voltage sensor to protect batteries from over discharge. Last operation to be programmed for fail secure (gate closed).

d. 20 amp, fully automatic regulated battery charger.

7. Gate operating alert Devices

a. Control cabinet mounted weather proof flashing light.

b. Control cabinet mounted configurable audible alert.

8. Controls:

a. Provide all contacts, control boards and other items necessary for operation with specified devices and with Security Control-Supplied devices.

9. Miscellaneous:

a. Weather-stripped drive rail slot in chassis and snow wiper blades for drive rail.

b. Dry contact output for Access Control System. Alarm output for gate ajar for setpoint period of time.

2.2 Electrical and Control Circuits:

1. Automatic gate electrical power circuits and control wiring shall be furnished and installed as shown on the Plans and approved shop drawings.

2. Rigid or PVC conduits shall be provided and installed for each power or control cable.

a. Conduits shall be sized for the purpose intended, but in no case shall conduit be less than 1 inch in diameter.

b. Paved areas where conduits are to be run shall be saw cut and have pavement replaced.

3. Contractor shall provide 1/2-inch thick steel plate over any open trenches where vehicles or aircraft travel.

Concrete: Concrete shall be of a commercial grade with a minimum 28-day compressive strength of 4,000 psi.

PART 3 – INSTALLATION

3.1 GENERAL

A. Install new gate aluminum drive rails onto existing gates in accordance to manufacturer requirements.

Install new operators on new operator support, see plan details.

Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.

Install gate operator in accordance with the manufacturer's printed instructions, current at the time of installation.

Coordinate locations of operators with contract drawings, other trades and shop drawings.

3.2 FACTORY TESTING

Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity.

1. Apply physical loads to the operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the fully rated capacity of the operator components.

Check all mechanical connections for tightness and alignment.

1. Check all welds for completeness and continuity.

2. Check welded corners and edges to assure they are square and straight.

Inspect painted finish for completeness.

1. Touch up imperfections prior to shipment.

Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

SEQUENCE OF OPERATION

The gate operators shall operate in a master/slave combination. They shall control the operation of the associated fence gates accordingly:

1. Master Gate Operator (Slave Gate Operator shall mimic all Master Gate Operations)
   a. Gate Open 1st Method:

      The vehicle(s) drive up to card reader(s). Card reader loop detector detects vehicle. Driver presents badge to reader and inputs pin code into card reader. Badge and pin code are compared via fiber optic network. Once accepted, gate operators open gate.

   b. Gate Close:

      Detector loops have detected vehicle safely passed through gate

      OR

      Gate open time has expired (initially set for 15 seconds).

      The gate operators shall close the gates and reset for next operation.

   c. Gate Open 2nd Method:

      Security staff or Supervisor actuates Gate Open button on the Smart Touch Control pad located on the Master Gate Operator. The gates shall open and stay open until commanded to close.

   d. Gate Close 2nd Method:

      Security staff or Supervisor actuates Gate Close button on the Smart Touch Control pad located on the Master Gate Operator and the gates close and reset for next operation.

Safety device operation and sequences shall be provided and programmed into the gate controller and is not part of the Access Control Sequence of Operations. The gate provider shall program and recommend required safety operations.

Gate alert devices (audible and visual) shall be provided and programmed into the gate controller and is not part of the Access Control Sequence of Operations. The gate provider shall program and recommend required safety operations.

Provide dry contact output to Access Control System for gate ajar alarm. Contact will close if either gate is ajar (as indicated by associated limit switch) for more than 2 minutes (user adjustable).

3.4 FIELD QUALITY CONTROL

A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion.
   1. Test limit switches for proper "at rest" gate position.

B. All anchor bolts shall be fully concealed in the finished installation.

3.5 CONTINUED SERVICE AND DOCUMENTATION

A. Train owner's personnel in the general maintenance of the gate operator and accessories
   1. Provide 4 copies of "operations and maintenance" manual for the owner's use per contract closeout requirements.
   2. Manuals will identify parts of the equipment for future procurement.

3.6 Method of Measurement

A. Gate operators (both Master and Slave) shall be measured per lump sum.

3.7 Basis of Payment

Payment will be made at the contact unit price for the gate operators, concrete foundations, photo eyes (gate edge) for pedestrian trap prevention, loop detectors, visual and audio warning system, battery backup and enclosures, connections to card readers, loop detectors, fence (gates), access control equipment, and all incidentals for a complete and working system, furnished and install by the Contractor and accepted by the Engineer.

ITEM NUMBER	DESCRIPTION	UNIT
L-160	Gate Operators	- per lump sum

END OF SECTION 323119 GATES OPERATOR

ITEM D555 DIRECTIONAL BORING

1. DESCRIPTION

1.1 Scope of Work: The work specified in this Section documents the approved construction methods, procedures and materials for Directional Boring, also commonly called Horizontal Directional Drilling (HDD).

1.2 General: HDD is a trenchless method for installing a product that serves as a conduit for liquids, gasses, or as a duct for pipe, cable, or wire line products. It is a multi-stage process consisting of site preparation and restoration, equipment setup, and drilling a pilot bore along a predetermined path and then pulling the product back through the drilled space. When necessary, enlargement of the pilot bore hole may be necessary to accommodate a product larger than the pilot bore hold size. This process is referred to as back reaming and is done at the same time the product is being pulled back through the pilot bore hole. Accomplish alignment of the bore by proper orientation of the drill bit head as it is being pushed into the ground by a hydraulic jack. Determine orientation and tracking of the drill bit by an above ground radio detection device which picks up a radio signal generated from a transmitter located within the drill bit head. Then electronically translate the radio signal into depth and alignment. In order to minimize friction and prevent collapse of the bore hole, introduce a soil stabilizing agent (drilling fluid) into the annular bore space from the trailing end of the drill bit. The rotation of the bit in the soil wetted by the drilling fluid creates a slurry. The slurry acts to stabilize the surrounding soil and prevent collapse of the bore hole as well as provides lubrication. Select or design drilling fluids for the site specific soil and ground water conditions. Confine free flowing (escaping) slurry or drilling fluids at the ground surface during pull back or drilling. Accomplish this by creating sump areas or vacuum operations to prevent damage or hazardous conditions in surrounding areas. Remove all residual slurry from the surface and restore the site to pre-construction conditions.

2. MATERIALS.

2.1 General: Materials are defined as pipe or conduit that becomes the installed product. Incidental materials that may or may not used to install the product depending on field requirements are not paid for separately and will be included in the cost of the installed product.

2.2 Material Type: The following material standards are to be interpreted as the minimum in place standards. Use materials that are appropriate for the stresses generated by the selected equipment and field conditions. It is not intended to portray that the use of materials with these minimum materials standards will retain their required properties if the stress limits are exceeded for which they were designed during installation. Ensure that the appropriate material is used to retain compliance once it is installed.
Material Standards for HDD Installation.

Material Standards HDD Installation		
Material Type	Non-Pressure	Pressure
Polyethylene (PE)	ASTM D 2447	ASTM 2513 ASTM D2447
High Density Polyethylene	ASTM D 2447 ASTM 3350 ASTM F 714 ASTM D30351/F2160	ASTM D 2447 ASTM 3350 ASTM F 714 ASTM 2513

		ASTM D30351/F2160
Polyvinyl-Chloride (PVC)	ASTM 789	N/A
Steel	ASTM A139 Grade B[1]	AWWA C200 API 2B[2]
[1]No hydrostatic test required [2]Dimensional tolerances only.		

3. CONSTRUCTION SITE REQUIREMENTS.

555-3.1 Qualifications: The contractor shall provide work reference for whom similar work has been conducted. A minimum of five year directional boring experience is required. A contact name and telephone number must be included for each reference. Conventional trenching experience or jack and bore experience will not be considered applicable. The contractors boring experience and references shall be submitted with the bid.

3.2 Site Conditions: Sump pits are required to contain drilling fluids if vacuum devices are not operated throughout the drilling operation, unless approved by the Engineer. Within 48 hours of completing installation of the boring product, clean the work site of all excess slurry or spoils. Take responsibility for the removal and final disposition of excess slurry or spoils. Insure that the work site is restored to pre-construction conditions or as identified on the plans. Exposure of product shall be limited to 3 feet (1 m) and 14 consecutive Days unless approved by the Engineer. Prior to all work in this section, carefully inspect the site and verify access to the points where this installation may properly commence. Verify that all work can be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards. Verify conflicts before start of work by exposing each utility. In the event of discrepancy, immediately notify the Engineer in writing. Deviations from the bore path due to underground obstructions will be discussed on-site with the Engineer and revised bore path may be drilled based upon consent of the Engineer. Do not proceed with installation in the areas of the discrepancy until all such discrepancies have been fully resolved.

3.2.1 Minimum Clearances: The minimum clearance between existing utilities and the bore hole are as follows:

-Cabling: 2 foot clearance.
-Duct banks, storm sewers, concrete pavements: 4 foot clearance.
-Fueling pipelines: 8 foot clearance.

These clearances are only recommended distances. If the contractor has concerns regarding settlement, damaging pipe, cabling or pavement sections a request shall be made to the Engineer detailing the clearances that can be successfully be completed while still preserving the directional bore integrity. If no response is received from the contractor it will be assumed the clearances listed above are acceptable for the directional drilling operation so settlement or heaving during and after construction shall not exceed 1/2-inch along the centerline of the conduit.

3.3 Damage Restoration: Take responsibility for restoration for any damage caused by heaving, settlement, separation of pavement, escaping drilling fluid (frac-out), or the directional drilling operation at no cost to the airport.

3.3.1 Remediation Plans: When required by the Engineer, provide detailed plans which show how damage to any runway or taxiway pavement will be remedied. These details will become part of the As-Built Plans

Package. Remediation Plans must follow the same guidelines for development and presentation of the As-Built Plans. When remediation plans are required, they must be approved by the Engineer before any work proceeds.

4. QUALITY CONTROL.

4.1 General: Take control of the operation at all times. Have a representative who is thoroughly knowledgeable of the equipment, boring and Department procedures, present at the job site during the entire installation and available to address immediate concerns and emergency operations. Notify the Engineer 48 hours in advance of starting work. Do not begin installation until the Engineer is present at the job site and agrees that proper preparations have been made.

4.1.1 Product Testing: When there is any indication that the installed product has sustained damage and may leak, stop all work, notify the Engineer and investigate damage. The Engineer may require a pressure test and reserves the right to be present during the test. Perform pressure test within 24 hours unless otherwise approved by the Engineer. Furnish a copy of test results to the Engineer for review and approval. The Engineer is allowed up to 72 hours to approve or determine if the product installation is not in compliance with the specifications. The Engineer may require non-compliant installations to be filled with excavatable flowable fill.

4.1.2 Testing Methods: Testing may consist of one of the following methods and must always meet or exceed the Department's testing requirements:
Follow the product manufacturer's pressure testing recommendations.

Ensure that product carrier pipes installed without a casing meet the pressure requirements set by the owner. If the owner does not require pressure testing, the Engineer may require at least one test. A watertight pipe and joint configuration where the product is installed beneath any pavement (including sidewalk) and front shoulders is required. The Engineer will determine when and where watertight joint requirements will be applied to the ultimate roadway section for future widening. When a product is located elsewhere, the pipe and joint configuration must meet or exceed soil tight joint requirements. Conduct tests for joint integrity for one hour. The test for soil tight joint allows up to 0.1 gallon [10.4 liter] of water leakage at a sustained pressure of 2 PSI [13.79 kPa]. The watertight joint criteria allows no leakage at all for a sustained pressure of 5 PSI [34.47 kPa].

4.1.3 Failed Bore Path: If conditions warrant removal of any materials installed in a failed bore path, as determined by the Engineer, it will be at no cost to the Department or Airport. Promptly fill all voids by injecting all taken out of service products that have any annular space with excavatable flowable fill.

4.2 Product Locating and Tracking: The Department recognizes walkover, wire line, and wire line with surface grid verification or any other system as approved by the Engineer, as the accepted methods of tracking directional bores. Use a locating and tracking system capable of ensuring that the proposed installation is installed as intended. If an area of radio signal interference is expected to exceed 5 feet [1.5 m], the Engineer may specify the use of a suitable tracking system. The locating and tracking system must provide information on:

Clock and pitch information
Depth
Transmitter temperature

Battery status
Position (x, y)
Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility)

Ensure proper calibration of all equipment before commencing directional drilling operation.

Take and record alignment readings or plot points such that elevations on top of and offset dimensions from the center of the product to a permanent fixed feature are provided. Such permanent fixed feature must have prior approval of the Engineer. Provide elevations and dimensions at all bore alignment corrections (vertical and horizontal) with a minimum distance between points of 100 feet [30 m]. Provide a sufficient number of elevations and offset distances to accurately plot the vertical and horizontal alignment of the installed product. A minimum of three elevation and plot points are required.

Install all facilities such that their location can be readily determined by electronic designation after installation. For non-conductive installations, a minimum of two separate and continuous conductive tracking (tone wire) materials, either externally, internally or integral with the product. Use either a continuous green sheathed solid conductor copper wire line (minimum #12 AWG for external placement or minimum #14 AWG for internal placement in the conduit casing) or a coated conductive tape. Conductors must be located on opposite sides when installed externally. Connect any break in the conductor line before construction with an electrical clamp or solder and coat the connection with a rubber or plastic insulator to maintain the integrity of the connection from corrosion. Clamp connections must be made of brass or copper and of the butt end type with wires secured by compression. Soldered connections must be made by tight spiral winding of each wire around the other with a finished length minimum of 3 inches [76mm] overlap. Tracking conductors must extend 2 feet [610 mm] beyond bore termini. Test conductors for continuity. Each conductor that passes must be identified as such by removing the last 6 inches [152 mm] of the sheath. No deductions are allowed for failed tracking conductors. Failed conductor ends must be wound into a small coil and left attached for future use.

4.3 <u>Product Bore Hole Diameter</u>: Minimize potential damage from soil displacement/settlement by limiting the radio of the borehole to the product size. The size of the back reamer bit or pilot bit, if no back reaming is required, will be limited relative to the product diameter to be installed as follows:

Maximum Pilot or Back-Reamer Bit Diameter When Rotated 360 Degrees	
Nominal Inside Pipe Diameter Inches [mm]	Bit Diameter Inches [mm]
2 [50]	4 [100]
3 [75]	6 [150]
4 [100]	8 [200]
6[150]	10 [250]
8 [200]	12 [300]
10[250]	14 [350]
12 [300] and greater	Maximum Product OD plus 6 [150]

4.4 <u>Drilling Fluids</u>: Use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a minimum pH of 6.0 to create the drilling fluid for lubrication and soil stabilization. Vary the fluid viscosity to best fit the soil conditions encountered. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the Engineer. Certify to the Engineer in writing that any chemicals to be added are environmentally safe and not harmful or corrosive to the facility_ Identify the source of water

for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds or fire hydrants. Any water source used other than a potable water may require a pH test.

4.5 Equipment Requirements: Ensure that appropriate equipment is provided to facilitate the installations as follows:

HDD Equipment				
System Description	Pipe [1]Diameter Inches [mm]	Bore Length Feet [m]	Torque Ft-lbs [nm]	Trust/Pullback Lbs [kN]
Maxi-HDD	18 [450] and greater	>1,000 [305]	>10,000 [13,558]	>70,000 [311,375]
Midi-HDD	Up to 16 [400]	Up to 1,000 [305]	1,900 to 9,999 [2,576 to 13,557]	20,001 to 69,999 [88,969 to 311,374]
Mini-HDD	Up to 6 [150]	Up to 600 [180]	Up to 1,899 [Up to 2,575]	Up to 20,000 [Up to 88,964]
[1] For the above, multiple pipe or conduit installations must not exceed the total pipe diameters state above.				

Match equipment to the size of pipe being installed. Obtain the Engineer's approval for installations differing from the above chart. Ensure that the drill rod can meet the bend radius required for the proposed installation.

4.6 Thrust/Pullback Requirements: Unless approved by the Engineer, limit use of HDD equipment to installing the following product sizes and lengths based on the following product size, force and length relationships.

HDD Bore Equipment Thrust/Pullback Capacity						
Lbs	5,000 to 7,000	7,001 to 12,000	12,001 to 16,000	16,001 to 25,000	25,001 to 40,000	>40,000
kN	22.241 to 31.138	31.139 to 53.379	53.380 to 71.172	71.173 to 111.206	111.207 to 117.929	>177.929
Product Size [1] Inches [mm]	Maximum Pullback Distance in Feet [m]					
4 [100] or <	400 [122] or <					
6 [150] or <		600 [183] or <				
8 [200] or <			800 [244] or <			
10 [250] or <				1,000 [305] or <		
12 [300] or <					2,000 [610] or <	
>12 [300]						Engineer's Discretion
[1] For the above, where a single pull of multiple conduits is to be attempted, the applicable product size must be determined by the diameter of a circle that will circumscribe the individual conduits as a group.						

5. DRILLING OPERATIONS.

5.1 Installation Process: Ensure adequate removal of soil cuttings and stability of the borehole by monitoring the drilling fluids such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming and pipe installation. Relief holes can be used as necessary to relieve excess pressure down hole. Obtain the Engineer's approval of the location and all conditions necessary to construct relief holes to ensure the proper disposition of drilling fluids is maintained and unnecessary inconvenience is minimized to other facility users. To minimize heaving during pull back, the pull back rate is determined in order to maximize the removal of soil cuttings without building excess down hole pressure. Contain excess drilling fluids at entry and exit points until they are recycled or removed from the site or vacuumed during drilling operations. Ensure that entry and exit pits are of sufficient size to contain the expected return of drilling fluids and soil cuttings. Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state or federal regulatory agencies. When drilling in suspected contaminated ground, test the drilling fluid for contamination and appropriately dispose of it. Remove any excess material upon completion of the bore. if in the drilling process it becomes evident that the soil is contaminated, contact the Engineer immediately. Do not continue drilling without the Engineer's approval. The timing of all boring processes is critical. Install a product into a borehole within the same day that the pre-bore is completed to ensure necessary support exits.

5.2 Boring Failure: If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer. Immediately fill the product left in place with excavatable flowable fill. Submit a new installation procedure and revised plans to the Engineer for approval before resuming work at another location. If, during construction, damage is observed to an existing airport facility, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the Engineer.

6 DOCUMENTATION REQUIREMENTS.

6.1 Boring Path Report: Furnish a Bore Path Report to the Engineer within seven days of the completion of each bore path. Include the following in the report:

1) Location of project and financial project number including the Permit Number when assigned
2) Name of person collecting data, including title, position and company name
3) Investigation site location (Contract plans station number or reference to a permanent structure within the project right-of-way)
4) Identification of the detection method used
5) Elevations and offset dimensions as required in 555-4.3

6.2 As-Built Plan: Provide the Engineer a complete set of As-Built Plans showing all bores (successful and failed) within 30 calendar days of completing the work. Ensure that the plans are dimensionally correct copies of the Contract plans and include roadway plan and profile, cross-section, boring location and subsurface conditions as directed by the Engineer. The plans must show appropriate elevations and be referenced to a Airport Bench Mark when associated with Department project, otherwise to a USGS grid system and datum, or a specific location on top of an existing Airport head wall. Plans must be same scale in black ink on white paper. of the same size and weight as the Contract plans. Submittal of electronic plans data in lieu of hard copy plans is preferred and may be approved by the Engineer if compatible with the Department software. Specific plans content requirements include but may not be limited to the following:

(a) The Contract plan view shows the centerline location of each facility installed, or installed and placed out of service, to an accuracy of 1 inch [25 mm] at the ends and other points physically observed in accordance with the bore path report.

(b) As directed by the Engineer, provide either a profile plan for each bore path, or a cross-section of the runway or taxiway at a station specified by the Engineer, or a runway or taxiway centerline profile. Show the ground or pavement surface and crown elevation of each facility installed, or installed and placed out of service, to an accuracy within 1 inch [25 mm] at the ends and other exposed locations. On profile plans for bore paths crossing the roadway show stationing of the crossing on the Contract plans. On the profile plans for the bore paths paralleling the runway or taxiway, show the Contract plans stationing. If the profile plan for the bore path is not made on a copy of one of the Contract profile or cross-section sheets, use a 10 to 1 vertical exaggeration.

(c) If, during boring, an obstruction is encountered which prevents completion of the installation in accordance with the design location and specification, and the product is left in place and taken out of service, show the failed bore path along with the final bore path on the plans. Note the failed bore path as "Failed Bore Path -Taken Out of Service". Also show the name of the Utility owner, location and length of the drill head and any drill stems not removed from the bore path. Show the top elevation, diameter and material type of all utilities encountered and physically observed during the subsoil investigation. For all other obstructions encountered during a subsoil investigation or the installation, show the type of material, horizontal and vertical location, top and lowest elevation observed, and note if the obstruction continues below the lowest point observed.

(d) Include bore notes on each plan stating the final bore path diameter, product diameter, drilling fluid composition, composition of any other materials used to fill the annular void between the bore path and product, or facility placed out of service. Note if the product is a casing as well as the size and type of carrier pipe within the casing as part of the Contract work.

8. BASIS OF PAYMENT.

Payment will be full compensation for all work specified in this Section, including all installations, from plan point of beginning to plan point of ending (i.e. pull box) at plan depth, product, tracking conductor, removal of excavated materials and spoils, removal and disposal of drilling fluids, backfilling, and complete restoration of the site. Bundled product in a single bore will be paid for as single bore based on the required drill bit head or back reamer head size. Separate payment shall not made for individual products in a bundle. The installation and attachment of tracking conductors (wire or tape) will be included in the cost of the bore and will not be paid for separately. No payment will be made for failed bore paths, injection of flowable fill, products taken out of service or incomplete installations. No payment will be made for directional boring until a Bore Path Report has been delivered to the Engineer. After the Engineer's acceptance of the Bore Path Report, payment will be made in the amount of 70% of the unit price bid, for Directional Boring. The remaining 30% of the unit price bid will be made after submittal of As-Built Plans, in accordance with 555-6.2.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
D555-8.1	Directional Bore 2W-2” Schedule 80 PVC	- per Linear Foot

END OF SECTION D555 DIRECTIONAL BORING

F-162 CHAIN LINK FENCE GATES

1. DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence with fabric buried two feet (2'-0") underground, and gates in accordance with these specifications and the details shown on the plans and in conformity with the lines and grades shown on the plans or established by the engineer.

2. MATERIALS

162-2.1 FABRIC. The fabric shall be woven with a 9-guage galvanized steel wire in a 2-inch (50mm) mesh and shall meet the requirements of ASTM A 392, Class 2.

162-2.2 BARBED WIRE. Barbed wire shall be 2 strand 12-1/2 gauge zinc coated wire with 4-point barbs and shall conform to the requirements of ASTM A 121, Class 3, chain link fence grade.

162-2.3 POST, RAILS AND BRACES. Line posts, rails and braces shall be galvanized steel pipe conforming to the requirements of ASTM F 1083. The steel used in all structural shapes shall conform to the requirements of ASTM A 572, Grade 45, and shall be galvanized in accordance with the requirements of ASTM F 1043, Type A. Roll-formed sections shall be fabricated from material meeting the requirements of ASTM A 570, Grade 45, and shall be galvanized in accordance with the requirements of ASTM F 1043, Type A. The dimensions of the posts, rails, and braces shall be in accordance with those shown on the plans.

162-2.4 GATES. Gate frames shall consist of galvanized steel pipe and shall conform to the specifications for the same material under paragraph 162-2.3. The fabric shall be the same type material as used in the fence.

162-2.5 WIRE TIES AND TENSION WIRES. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Wire fabric ties shall be hog rings of galvanized steel wire not less than 9-guage. Tension wire shall be 7-gauge marcelled steel wire with same coating as the fabric type and shall conform to ASTM A 824.

162-2.6. MISCELLANEOUS FITTINGS AND HARDWARE. Miscellaneous steel fittings and hardware for use with galvanized steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balance design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A 153. Barbed wire support arms shall withstand a load of 250 (113kg) pounds applied vertically to the outermost end of the arm. Barbed wire support arms shall be two feet (2'-0") high applied at a 45 degree angle.

162-2.7. CONCRETE. Concrete shall be of commercial grade with a minimum 28-day compressive strength of 3,000 psi.

162-2.8. MARKING. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the guage of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

3. CONSTRUCTION METHODS

162-3.1 CLEARING FENCE LINE. All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of 5 feet on either side of the fence centerline before starting fencing operations. The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction unless otherwise noted on the plan set and/or on the bid schedule.

162-3.2 INSTALLING POSTS. All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans. Post should be spaced not more than 10 feet (3m) and should be set a minimum of 48 inches on concrete footings. If the frost depth is greater than 48 inches, the posts should be set accordingly. The post holes shall be in a straight and proper alignment and to a depth such that there is a minimum of 3 inches (75mm) of concrete on all sides of the posts.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All post shall be plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within 7 days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches. After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.3 INSTALLING TOP RAILS. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

162-3.4 INSTALLING BRACES. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts, corner posts, and brace panel sections.

162-3.5 INSTALLING FABRIC. The wire fabric shall be firmly attached to the posts and braced. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground. Excavate ground to the depth required for proper installation of the fabric. Obtain Engineer's approval of the depth of excavation before placing the wire fabric. Place the fabric and lap splice it to existing fence fabric and tie with ties at 2 foot – 0 inch spacing. Cut wire fabric around fence post footing to allow proper placement. Backfill with native soil to original grade. Compact all backfill and fill to attain 90% compaction per AASHTO T-180. The bottom of the fence fabric shall be buried no less than 2'-0" from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

162-3.6 INSTALLING GATES. The gates shall be installed plumb and level. The double leaf gate shall be installed on two 4" O.D. posts set in concrete 12" in diameter and to 48" below grade. The gate shall be diagonally trussed and all hardware shall be installed by means which will prevent unauthorized removal. The gate shall be furnished with a 1.5' wide by 4' deep reinforced concrete sill into which are embedded a stainless steel gate latch stop as detailed within the plans. Install ¾" expansion material between the concrete sill and the gate post concrete.

162-3.7 ELECTRICAL GROUNDS. Electrical grounds shall be constructed at 800' intervals and where a power line passes over the fence. The ground shall be installed directly below the point of crossing. The ground shall be accomplished with a copper clad rod a minimum of 8 feet long and a minimum of 5/8 inch in diameter driven vertically until the top of the rod is 6 inches below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to the fence construction.

4. METHOD OF MEASUREMENT

162-4.1 Chain link fence removal will be measure for payment by the linear foot of chain link fence removal. Measurement shall be along the fence from center to center of end or corner posts, excluding the length occupied by gate openings.

162-4.2 New chain link fence will be measured for payment by the linear foot of new chain link fence. Measurement shall be along the fence from center to center of end or corner posts, excluding the length occupied by gate openings.

162-4.3 Gates will be measured as complete units including all concrete sills, reinforcing, stainless steel gate latches, and expansion fabric per each.

5. BASIS OF PAYMENT

162-5.1 Payment for chain link fence removal will be made at the contract unit price per linear foot of chain link fence removed.

162-5.2 Payment for new chain link fence will be made at the contract unit price per linear foot of new chain link fence.

162-5.3 Payment for gates will be made at the contract unit price per each.

The unit prices shall be full compensation for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
F162- 5.1	Remove Existing Chain Link Fence	per linear foot
F162- 5.2	Fence, Chain Link, 12-Foot	per linear foot
F162- 5.3	Gates, Chain Link, 20-Foot	per each

MATERIAL REQUIREMENTS

ASTM A 121	Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 123	Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardward
ASTM A 392	Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 446	Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 569	Steel, Carbon (0.15 Maximum, Percent), Hot Rolled Sheet and Strip Commercial Quality
ASTM A 570	Hot Rolled Carbon Steel Sheet and Strip Structural Quality
ASTM A 572	High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
ASTM A 585	Aluminum-Coated Steel Barbed Wire
ASTM A 824	Mettalic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM B 117	Standard Test Method of Salt Spray (Fog) Testing
ASTM F 1043	Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
ASTM F 1083	Pipe, Steel, Hot-Dipped Zinc coated (galvanized) Welded, for Fence Structures
ASTM F 1234	Protective Coatings on Steel Framework for Fences
ASTM G 23	Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 26	Operating for Light Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 53	Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

END OF SECTION F-162 CHAIN LINK FENCE GATES

ITEM X162-5.1, X162-5.2, X162-5.3
TEMPORARY CHAIN LINK FENCING AND GATES, 8 FOOT

Work under this item shall conform to the requirements of Section F162 and supplemented as follows:

1. DESCRIPTION

This work shall consist of installing temporary chain link fencing, barbed wire and 30' wide security gates at the locations shown on the plans and according to the phasing and specifications of the project. This work also consists of furnishing and constructing temporary fence ditch crossings where indicated on the plans. At completion of their use, these pay items shall also include the removal of the temporary fencing, gates, and ditch crossings and re-grading as necessary and restoration of vegetation.

2. MATERIALS

All materials shall conform to the requirements as specified in Section F162 with the following allowed exceptions.

(a) At the Contractor's option, fencing fabric line posts and barbed wire removed from other areas of the project may be salvaged for re-use as the temporary fence.

(b) Regardless of whether the temporary fence consists of new or salvaged materials identified above, the contractor shall provide new corner posts, bracer posts, and terminal posts in accordance with the alignment of the temporary fence shown on the plans. The posts shall be of the same material specified for new chain link fence. Line posts do not need to be set in concrete, but shall be driven to a 4' minimum depth to allow the fence fabric to be tensioned and secured. No separate payment will be made for these new posts, anchoring or any other incidentals necessary to install the new or salvaged material used for temporary fence.

3. CONSTRUCTION METHODS

(a) Contractor shall maintain secured fencing and gates around project work areas at all times.

(b) No existing perimeter fencing shall be removed in a manner to impact security until the temporary security fencing has been installed in its final location.

(c) Temporary fencing shall tie to the existing perimeter fence at a newly constructed terminal post. The Contractor shall fill any resulting gaps between the temporary fence and the existing perimeter fence by wiring a section of chain link fabric between the two fence sections.

(d) The temporary fence shall follow the contour of the ground, with the bottom of the fence in contact with the ground to provide no gaps. Perform grading where necessary to provide a uniform and consistent contact of the fence bottom with the ground surface.

(e) For locations where the temporary fencing and gate posts will cross existing pavement, the Contractor shall core a 6" diameter hole to receive the line post.

(f) Due to the variation in width and depth of the ditch crossings, a variety of post lengths and quantity may be encountered. Contractor is to ensure that the vertical clearance between sections of brace bars shall be 6 inches or less. At no point within the ditch crossing shall there be an opening greater than 6” vertical.

(g) Upon installation of the final security fencing, the temporary fencing, ditch crossings and gates shall be removed along with any posts, concrete base footings, wires or associated materials and the area re-graded, top-soiled and seeded to the satisfaction of the engineer. All removals and restoration work associated with these pay items shall not constitute a pay item and shall be incidental to the work.

(h) Temporary fence or gates posts located in existing pavement shall be filled with hot mix asphalt pavement, Type E-3, or concrete upon removal as directed by the engineer.

4. METHOD OF MEASUREMENT

Temporary chain link fence will be measured for payment in its final installed locations, by linear foot. Temporary Gate Chain Link 30 FT will be measured by the unit each, measured in their final locations and in accordance with the contract. Temporary Fence – Ditch Crossing will be measure for payment in its final installed location by linear foot, from top of ditch slope to top of ditch slope.

5. BASIS OF PAYMENT

All labor equipment and materials required to complete this work shall be considered incidental to this item.

Payment will be made under:

ITEM NUMBER	DESCRIPTION	UNIT
Item No. X162-5.1	Temporary Chain Link Fence, 8-Foot	per linear foot
Item No. X162-5.2	Temporary Gate Chain Link 30-Ft	per each
Item No. X162-5.3	Temporary Fence-Ditch Crossing	per linear foot

END OF SECTION X162-5.1, X162-5.2, X162-5.3 TEMPORARY CHAIN LINK FENCING & GATES, 8 FOOT

CONDUIT RIGID NONMETALLIC SCHEDULE 40 3-INCH, ITEM 652.0235

This work consists of furnishing and installing PVC conduits in accordance to section 652 of the standard specifications, and as shown in the plan details.

Locations of the conduits where they are required are identified in the plans. However, installation will require integration with existing field conditions. Appropriate adjustment on conduit locations may be made if the field conditions are such that the pipes cannot be installed at the specified locations. Any relocation of greater than five feet must be approved by the engineer.

Plan changes must be approved by the City of Milwaukee Electric Services Supervisor. The primary contacts are Mr. Dennis Miller, Street Lighting Supervisor (414) 286-5942-office, (414) 708-4251-mobile; or Mr. George Berdine, Street Lighting Supervisor (414) 286-5943-office, (414) 708-4245-mobile.

END OF SECTION ITEM 652.0235 CONDUIT RIGID NONMETALLIC SCHEDULE 40 3-INCH