CONTRACT CHANGE ORDER NO. 1

AIRPORT	Augusta Regional Airport	**Date**	March 28, 2024
LOCATION	Augusta, GA	**AIP No.**	N/A
PROJECT	Construct Taxiway G / Apron G– 0119700-210447.01	**CONTRACTOR**	Independence Excavating Inc.

You are requested to perform the following described work upon receipt of an approved copy of this document or as directed by the engineer.

Item No.	Bid Alternate	Description	Unit	Unit Price	Quantity	Amount
Quantity Adjustment Items – Base Bid						
C-102.1a	Base	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	LF	$4.00	-7,586	($30,344.00)
C-102.1b	Base	Construct, Maintain, and Remove Inlet Sediment Trap	EA	$350.00	-39	($13,650.00)
C-102.1f	Base	Emergency Erosion Control Mobilization	LS	$2,500.00	-1	($2,500.00)
P-101.1	Base	Full Depth Asphalt Pavement Removal	SY	$30.00	-143	($4,290.00)
P-101.2	Base	Cold Milling	SY	$20.00	-233	($4,660.00)
P-152.1	Base	Unclassified Excavation, Remove Off-Site	CY	$30.00	3,930	$117,900.00
P-152.4	Base	Unsuitable/Over Excavation	CY	$28.00	-4,975	($139,300.00)
P-501.1	Base	Portland Cement Concrete Pavement (14")	SY	$145.00	-15,402	($2,233,290.00)
P-501.1	Base	Portland Cement Concrete Pavement (14")	SY	$149.50	15,402	$2,302,599.00
P-620.2	Base	Temporary Pavement Markings	SF	$1.10	-9,393	($10,332.30)
T-901.3	Base	Seeding, Staging Area	AC	$2,300.00	-1	($2,300.00)
T-905.2	Base	Topsoil, Staging Area	CY	$8.00	-2,762	($22,096.00)
Quantity Adjustment Items – Bid Alternate 1						
C-102.1a	1	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	LF	$4.00	-7,586	($30,344.00)
C-102.1b	1	Construct, Maintain, and Remove Inlet Sediment Trap	EA	$350.00	-48	($16,800.00)
C-102.1c	1	Construct, Maintain, and Remove Construction Exit	EA	$12,000.00	-1	($12,000.00)
C-102.1f	1	Emergency Erosion Control Mobilization	LS	$2,500.00	-1	($2,500.00)
P-152.2	1	Unclassified Excavation, Select Fill from On-Site Material	CY	$20.00	4,222	$84,440.00
P-152.4	1	Unsuitable/Over Excavation	CY	$28.00	-4,500	($126,000.00)
P-501.1	1	Portland Cement Concrete Pavement (14")	SY	$105.00	-35,331	($3,709,755.00)
P-501.1	1	Portland Cement Concrete Pavement (14")	SY	$109.50	35,331	$3,868,744.50
P-620.2	1	Temporary Pavement Markings	SF	$0.65	-30,223	($19,644.95)
P-620.5	1	Temporary Displaced Threshold	LS	$125,000	-1	($125,000.00)
D-701.1	1	Concrete Sewer Pipe, 18-inch, Class V	LF	$170.00	-186	($31,620.00)
D-701.2	1	Concrete Sewer Pipe, 24-inch, Class V	LF	$200.00	-89	($17,800.00)
T-901.3	1	Seeding Staging Area	AC	$2,300.0	-1	($2,300.00)
T-905.2	1	Topsoil Staging Area	CY	$7.00	-2,762	($19,334.00)
L-108.4	1	No. 6, 600V, XHHW Cable	LF	$4.25	1,200	$5,100.00
Extra Work/New Bid Item – Base Bid						
L-110.7	Base	Lower Existing Home Run	LF	$29.00	125	$3,625.00

Extra Work/New Bid Item – Bid Alternate 1						
P-152.1	1	Unclassified Excavation, Remove Off-Site	CY	$30.00	7,341	$220,230.00
P-152.5	1	Unclassified Excavation, Stockpile On-Site	CY	$20.00	4,926	$98,520.00
D-701.3	1	Concrete Sewer Pipe, 30-inch, Class V	LF	$250.00	274	$68,500.00
D-751.5	1	24" RCP & Manholes Misc. Costs	LS	$23,500.00	1	$23,500.00
L-108.5	1	No. 4, 600V, XHHW Cable	LF	$9.79	2,400	$23,496.00
L-108.6	1	1/0 Bare Guard Wire	LF	$12.24	550	$6,732.00
L-110.6	1	Split Conduit for FAA Cables	LF	$92.50	470	$43,475.00
This Change Order Total						**$291,001.25**
This Change Order Calendar Day Additions (Deletions)						**0**
Previous Change Order(s) Total						**$0.00**
Previous Change Order(s) Calendar Day Additions (Deletions)						**0**
Original Contract Total						**$11,877,051.10**
Original Contract Calendar Day Count Total						**320**
Revised Contract Total						**$12,168,052.35**
Revised Contract Calendar Day Count Total						**320**

The time provided for completion in the contract is unchanged (~~decreased~~) (~~increased~~) by **0 calendar days**. This document shall become the First Amendment to the contract and all provisions of the contract will apply.

Recommended by: _____ _____
Edwin J Scott, Jr., PE, Engineer (Mead & Hunt, Inc.) **Date**

Approved by: _____ _____
Dan Troutman, Chairman (Augusta Aviation Commission) **Date**

Approved by: _____ _____
Garnett L. Johnson, Mayor (Augusta, Georgia) **Date**

Attested by: _____ _____
Lena J. Bonner, Clerk of Commission (Augusta, Georgia) **Date**

Accepted by: _____ _____
Contractor (Independence Excavating Inc.) **Date**

AIP NO. N/A **CHANGE ORDER NO.** 1

AIRPORT Augusta Regional Airport (AGS) **LOCATION** Augusta, GA

JUSTIFICATION FOR CHANGE

1. Brief description of the proposed contract Amendment and location(s).

Quantity Adjustments:

There are items included in the original bid that need to be adjusted in order to cover the quantities and revised unit cost shown on the construction plans to complete the approved project scope. These items include:

- **C-102.1a Installation, Maintenance, and Removal of Silt Fence or Silt Sock – Base Bid, Bid Alternate 1:**
  - As-constructed quantity
- **C-102.1b Construct, Maintain, and Remove Inlet Sediment Trap – Base Bid, Bid Alternate 1:**
  - As-constructed quantity
- **C-102.1c Construct, Maintain, and Remove Construction Exit – Bid Alternate 1:**
  - As-constructed quantity
- **C-102.1f Emergency Erosion Control Mobilization– Base Bid, Bid Alternate 1:**
  - As-constructed quantity
- **P-101.1 Full Depth Asphalt Pavement Removal – Base Bid:**
  - As-constructed quantity
- **P-101.2 Cold Milling– Base Bid:**
  - As-constructed quantity
- **P-152.1 Unclassified Excavation, Remove Off-Site – Base Bid:**
  - As-constructed quantity, Additional removal required within project limits.
- **P-152.2 Unclassified Excavation, Select Fill from On-Site Material – Bid Alternate 1:**
  - As-constructed quantity, Additional material required within project limits.
- **P-152.4 Unsuitable/Over Excavation – Base Bid, Bid Alternate 1:**
  - As-constructed quantity
- **P-501.1 Portland Cement Concrete Pavement (14") – Base Bid, Bid Alternate 1:**
  - Revised unit cost based on the revised/IFC jointing plans along the selected concrete shoulder option.
- **P-620.2 Temporary Pavement Markings – Base Bid, Bid Alternate 1:**
  - As-constructed quantity
- **P-620.5 Temporary Displaced Threshold – Bid Alternate 1:**
  - Removed from project.
- **D-701.1 Concrete Sewer Pipe, 18-inch, Class V – Bid Alternate 1:**
  - As-constructed quantity
- **D-701.2 Concrete Sewer Pipe, 24-inch, Class V – Bid Alternate 1:**
  - As-constructed quantity
- **T-901.3 Seeding, Staging Area – Base Bid, Bid Alternate 1:**
  - As-constructed quantity
- **T-905.2 Topsoiling, Staging Area – Base Bid:**
  - As-constructed quantity
- **L-108.4 No. 6, 600V, XHHW Cable – Bid Alternate 1:**
  - As-constructed quantity

Extra Work/New Bid Item:

There are several items that were erroneously not included in the original bid or extra items not included in the original bid that will be necessary to complete the approved project scope. These items include:

- **P-152.1 Unclassified Excavation, Remove Off-Site – Bid Alternate 1:** Within the original bid documents, there was not a defined line item or quantity for unclassified excavation to be removed off-site in bid alternate 1, however during construction, excess material was produced and needed to be disposed of.
- **P-152.5 Unclassified Excavation, Stockpile On-Site – Bid Alternate 1:** Within the original bid documents, there was not a defined line item or quantity for unclassified excavation to be stockpiled on-site. In order to mitigate additional costs relating to additional unclassified excavation, the contractor was allowed to stockpile some material onsite.
- **D-701.3 Concrete Sewer Pipe, 30-inch, Class V:** The addition of new 30-inch concrete sewer pipe to replace the original 24-inch pipe within the project.

- **D-751.5 24" RCP & Manholes Misc. Costs:** The addition of this line item is associated with miscellaneous costs for two proposed storm manholes and 24" RCP not included within the original contract. The pipe is not being installed as part of the scope of the project but is being left to the Owner. The two manholes have been removed from the scope of the project however there are misc. costs associated with returning.
- **L-108.5 No. 4, 600V, XHHW Cable:** No. 4 600V cable is required for the AWOS. It was not included within the original contract.
- **L-108.6 1/0 Bare Guard Wire:** 1/0 Bare Guard wire is required for the AWOS. It was not included within the original contract.
- **L-110.6 Split Conduit for FAA Cables:** The addition of split PVC conduit required to encase the existing FAA cables within the project limits.
- **L-110.7 Lower Existing Home Run:** This cost is associated with the labor required to lower the existing electrical conduit within the project limits.

New Construction Specifications:

N/A

Revised Construction Specifications

- **P-152 Excavation, Subgrade, and Embankment**
- **D-701 Pipe for Storm Drains and Culverts**
- **D-751 Manholes, Catch Basins, Inlets, and Inspection Holes**
- **L-108 Underground Power Cable for Airports**
- **L-110 Airport Underground Electrical Duct Banks and Conduit**

2. Reason(s) for the change(s) *(Continue on reverse if necessary)*

Note: The quantity of the following items did not change substantially enough to justify renegotiation of any of the original unit prices in the base bid.

C-102.1a Installation, Maintenance, and Removal of Silt Fence or Silt Sock – The reduction of quantity in the base bid and bid alternate 1 associated with the installation of the silt fence/silt sock is a result of the as performed/installed quantities per the scope of work.

C-102.1b Construct, Maintain, and Remove Inlet Sediment Trap – The reduction of quantity in the base bid and bid alternate 1 associated with the installation of the inlet sediment trap is a result of the as performed/installed quantities per the scope of work.

C-102.1c Construct, Maintain, and Remove Construction Exit– The reduction of quantity in bid alternate 1 associated with the installation of the construction exit is a result of the as performed/installed quantities per the scope of work.

C-102.1f Emergency Erosion Control Mobilization – The reduction of quantity in the base bid and bid alternate 1 associated with Emergency Erosion Control Mobilization is a result of the as performed quantities per the scope of work.

P-101.1 Full Depth Asphalt Pavement Removal – The reduction of quantity in the base bid associated with full depth pavement removal is a result of the as performed/constructed quantities per the scope of work.

P-101.2 Cold Milling – The reduction of quantity in the base bid associated with asphalt pavement milling is a result of the as performed/constructed quantities per the scope of work.

P-152.1 Unclassified Excavation, Remove Off-Site – The additional quantity in the base bid and bid alternate 1 associated with unclassified excavation is a result of the as performed/excavated material quantities per the scope of work. Within the original bid documents, there was not a defined line item or quantity for unclassified excavation to be removed off-site in bid alternate 1, however during construction, excess material was produced and needed to be disposed of.

P-152.2 Unclassified Excavation, Select Fill from On-Site Material – The additional quantity in bid alternate 1 associated with unclassified excavation select fill quantity is a result of the as performed/placed material quantities per the scope of work.

P-152.4 Unsuitable/Over Excavation – The reduction of quantity in the base bid and bid alternate 1 associated with unsuitable/over excavation is a result of the as performed quantities per the scope of work.

P-152.5 Unclassified Excavation, Stockpile On-Site – Within the original bid documents, there was not a defined line item or quantity for unclassified excavation to be stockpiled on-site. In order to mitigate additional costs relating to additional unclassified excavation, the contractor was allowed to stockpile excavated material onsite.

P-501.1 Portland Cement Concrete Pavement (14" Depth) – When bidding the project, several alternate options were provided to prospective contractors. This was done to try and maximize potential funding opportunities. The selected contractor, Independence Excavating, was the responsive and overall low bidder. The bid option selected was a concrete taxiway with concrete shoulders. Because of the general environment surrounding concrete prices, it was not known whether or not this option would produce the most fiscally responsible option, therefore, a fully designed jointing plan was not provided in the bid documents. In order to construct the concrete shoulders as designed and issued in an RFI and within the IFC set of plans, additional steel is required resulting in a slightly higher unit price for construction.

P-620.2 Temporary Pavement Markings – The reduction of quantity in the base bid and bid alternate 1 associated with temporary pavement markings is a result of the as performed/installed quantities per the scope of work.

P-620.5 Temporary Displaced Threshold – The removal of this line item is due to requests made by the Airlines and Airport staff. When phasing the work within the Runway Safety Area, the temporary displacement of the Runway 35 threshold was determined to be the best option when constructing the new taxiway. This option would allow the contractor to work 24 hours a day without having to modify grades within the RSA and work within a modified construction window. However, per comments received from the Airlines, it was requested that this work be completed via nightly closures and/or other modified working windows thus removing this line item and associated scope from the project.

D-701.1 Concrete Sewer Pipe, 18-inch, Class V – The reduction of quantity in bid alternate 1 associated with the 18-inch concrete sewer pipe is a result of the as performed/installed quantities per the scope of work.

D-701.2 Concrete Sewer Pipe, 24-inch, Class V – The reduction of quantity in bid alternate 1 associated with the 24-inch concrete sewer pipe is a result of the as performed/installed quantities per the scope of work.

D-701.3 Concrete Sewer Pipe, 30-inch, Class V – Within the original contract, 24-inch concrete sewer pipe was called out to be installed under Taxiway G, however, after bids were received and the contract was executed, the drainage engineer reviewed and determined that 30-inch pipe was required in place of the proposed 24-inch pipe. This new line item and quantity is to replace the 24-inch and 18-inch pipe shown under Taxiway G.

D-751.5 24" RCP & Manholes Misc. Costs – The addition of this line item within the bid alternate is associated with miscellaneous costs for two proposed storm manholes and 24" RCP not included within the original contract. The pipe is not being installed as part of the scope of the project but is being left to the Owner. The two manholes have been removed from the scope of the project however there are misc. costs associated with the shipping/handling/returning of the structures.

T-901.3 Seeding, Staging Area – The reduction of quantity in the base bid and bid alternate 1 associated with the staging area seeding is a result of the as performed quantities per the scope of work.

T-905.2 Topsoiling, Staging Area – The reduction of quantity in the base bid and bid alternate 1 associated with the topsoil within the staging area is a result of the as performed quantities per the scope of work.

L-108.4 No. 6, 600V, XHHW Cable – The increase of quantity in bid alternate 1 associated with the #6, 600V Cable is a result of the as performed quantities per the scope of work. Not originally included within the original contract was the quantity of cable to run back to the Electrical Vault.

L-108.5 No. 4, 600V, XHHW Cable – The addition of this line item in bid alternate 1 is associated with the #4, 600V Cable not originally included within the original contract to run back to the Electrical Vault.

L-108.6 1/0 Bare Guard Wire – The addition of this line item in bid alternate 1 is associated with the #4 and #6, 600V Cable associated with the AWOS. This was not originally included within the original contract.

L-110.6 Split Conduit for FAA Cables – When construction and grading efforts began, the contractor and engineer contacted FAA tech ops to locate all known utilities within the project limits. Besides the cables and conduits shown on the plans, additional cable had been installed within the project area which was completed by the FAA itself. In order to complete the work, and protect the FAA equipment, split conduit and concrete encasement was required to be installed along the cables.

L-110.7 Lower Existing Home Run – During grading/paving and drainage installation operations, it was determined that a portion of the existing homerun duct bank was too shallow. In order to provide the necessary cover over the duct bank as required within the Advisory Circular, the contractor excavated approximately 125 lf of conduit, lowered all of the utilities within that stretch, and regraded the area.

3. The Sponsor's share of this cost is available from:
General/Enterprise Funds

4. If this is a supplemental agreement involving more than $2,000, is the cost estimate based on the latest wage rate decision? Yes ☐ No ☐ Not Applicable ☒

5. Has consent of surety been obtained? Yes ☐ Not Necessary ☒

6. Will this change affect the insurance coverage? Yes ☐ No ☒

7. If yes, will the policies be extended? Yes ☐ No ☐ Not Applicable ☒

8. Has this Change Order been discussed with FAA officials? Yes ☐ No ☒

When: N/A With Whom: N/A

Comment(s):

Augusta Regional Airport
Construct Taxiway G/Apron G

Progress Payment Application: CCO #1
For Period Ending: 28 Mar 2024

CCO No.	Spec.	Description	Unit of Issue	Quantity	Unit Price	Extended Price	Approved Quantity	Approved Amount	Quantity to Date	Amount to Date
BASE BID										
1	C-102.1a	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	LF	-7,586	$ 4.00	$ (30,344.00)	0.00	$ -	0.00	$ -
1	C-102.1b	Construct, Maintain, and Remove Inlet Sediment Trap	EA	-39	$ 350.00	$ (13,650.00)	0.00	$ -	0.00	$ -
1	C-102.1f	Emergency Erosion Control Mobilization	LS	-1	$ 2,500.00	$ (2,500.00)	0.00	$ -	0.00	$ -
1	P-101.1	Full Depth Asphalt Pavement Removal	SY	-143	$ 30.00	$ (4,290.00)	0.00	$ -	0.00	$ -
1	P-101.2	Cold Milling	SY	-233	$ 20.00	$ (4,660.00)	0.00	$ -	0.00	$ -
1	P-152.1	Unclassified Excavation, Remove Off-Site	CY	3,930	$ 30.00	$ 117,900.00	0.00	$ -	1,843.00	$ 55,290.00
1	P-152.4	Unsuitable/Over Excavation	CY	-4,975	$ 28.00	$ (139,300.00)	0.00	$ -	0.00	$ -
1	P-152.5	Unclassified Excavation, Stockpile On-Site	CY	0	$ 20.00	$ -	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	-15,402	$ 145.00	$ (2,233,290.00)	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	15,402	$ 149.50	$ 2,302,599.00	0.00	$ -	0.00	$ -
1	P-620.2	Temporary Pavement Markings	SF	-9,393	$ 1.10	$ (10,332.30)	0.00	$ -	0.00	$ -
1	T-901.3	Seeding Staging Area	AC	-1	$ 2,300.00	$ (2,300.00)	0.00	$ -	0.00	$ -
1	T-905.2	Topsoil Staging Area	CY	-2,762	$ 8.00	$ (22,096.00)	0.00	$ -	0.00	$ -
1	L-110.7	Lower Existing Home Run	LF	125	$ 29.00	$ 3,625.00	0.00	$ -	0.00	$ -
		BASE BID SUBTOTAL				**$ (38,638.30)**		**$ -**		**$ 55,290.00**
BID ALT 1										
1	C-102.1a	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	LF	-7,586	$ 4.00	$ (30,344.00)	0.00	$ -	0.00	$ -
1	C-102.1b	Construct, Maintain, and Remove Inlet Sediment Trap	EA	-48	$ 350.00	$ (16,800.00)	0.00	$ -	0.00	$ -
1	C-102.1c	Construct, Maintain, and Remove Construction Exit	EA	-1	$ 12,000.00	$ (12,000.00)	0.00	$ -	0.00	$ -
1	C-102.1f	Emergency Erosion Control Mobilization	LS	-1	$ 2,500.00	$ (2,500.00)	0.00	$ -	0.00	$ -
1	P-152.1	Unclassified Excavation, Remove Off-Site	CY	7,341	$ 30.00	$ 220,230.00	0.00	$ -	0.00	$ -
1	P-152.2	Unclassified Excavation, Select Fill from On-Site Material	CY	4,222	$ 20.00	$ 84,440.00	0.00	$ -	0.00	$ -
1	P-152.4	Unsuitable/Over Excavation	CY	-4,500	$ 28.00	$ (126,000.00)	0.00	$ -	0.00	$ -
1	P-152.5	Unclassified Excavation, Stockpile On-Site	CY	4,926	$ 20.00	$ 98,520.00	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	-35,331	$ 105.00	$ (3,709,755.00)	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	35,331	$ 109.50	$ 3,868,744.50	0.00	$ -	0.00	$ -
1	P-620.2	Temporary Pavement Markings	SF	-30,223	$ 0.65	$ (19,644.95)	0.00	$ -	0.00	$ -
1	P-620.5	Temporary Displaced Threshold	LS	-1	$ 125,000.00	$ (125,000.00)	0.00	$ -	0.00	$ -
1	D-701.1	Concrete Sewer Pipe, 18-inch, Class V	LF	-186	$ 170.00	$ (31,620.00)	0.00	$ -	0.00	$ -
1	D-701.2	Concrete Sewer Pipe, 24-inch, Class V	LF	-89	$ 200.00	$ (17,800.00)	0.00	$ -	0.00	$ -
1	D-701.3	Concrete Sewer Pipe, 30-inch, Class V	LF	274	$ 250.00	$ 68,500.00	0.00	$ -	0.00	$ -
1	D-751.5	24" RCP & Manholes Misc. Costs	LS	1	$ 23,500.00	$ 23,500.00	0.00	$ -	0.00	$ -
1	T-901.3	Seeding Staging Area	AC	-1	$ 2,300.00	$ (2,300.00)	0.00	$ -	0.00	$ -
1	T-905.2	Topsoil Staging Area	CY	-2,762	$ 7.00	$ (19,334.00)	0.00	$ -	0.00	$ -
1	L-108.4	No. 6, 600V, XHHW Cable	LF	1,200	$ 4.25	$ 5,100.00	0.00	$ -	0.00	$ -
1	L-108.5	No. 4, 600V, XHHW Cable	LF	2,400	$ 9.79	$ 23,496.00	0.00	$ -	0.00	$ -
1	L-108.6	1/0 Bare Guard Wire	LF	550	$ 12.24	$ 6,732.00	0.00	$ -	0.00	$ -
1	L-110.6	Split Conduit for FAA Cables	LF	470	$ 92.50	$ 43,475.00	0.00	$ -	0.00	$ -
		BID ALT 1 SUBTOTAL				**$ 329,639.55**		**$ -**		**$ -**
		CHANGE ORDER 1 TOTAL				**$ 291,001.25**		**$ -**		**$ 55,290.00**
		PROJECT TOTAL				**$ 291,001.25**		**$ -**		**$ 55,290.00**
					Subtotal	#REF!		$0.00		$0.00

Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature.

152-1.3 Unsuitable excavation. Unsuitable material shall be disposed in designated waste areas as shown on the plans. Materials containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the RPR.

CONSTRUCTION METHODS

152-2.1 General.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of in waste areas as shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the RPR.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per Section 70, paragraph 70-20. At the direction of the RPR, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

a. Blasting. Blasting shall not be allowed.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. The Contractor and RPR shall agree that the original ground lines shown on the original topographic mapping are accurate or agree to any adjustments made to the original ground lines.

Digital terrain model (DTM) files of the existing surfaces, finished surfaces, and other various surfaces were used to develop the design plans.

Volumetric quantities were calculated by comparing DTM files of the applicable design surfaces and generating Triangle Volume Reports. Electronic copies of DTM files and a paper copy of the original topographic map will be issued to the successful bidder.

Volumetric quantities were calculated using design cross sections which were created for this project using the DTM files of the applicable design surfaces and generating End Area Volume Reports. Paper copies of design cross sections and a paper copy of the original topographic map will be issued to the successful bidder.

Existing grades on the design cross sections or DTM's, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM's. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 0.1 foot of the stated elevations for ground surfaces, or within 0.1 foot for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered "no change". Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify the RPR in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM's. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the RPR. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes as shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the RPR. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the RPR shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed off the airport. The cost is incidental to this

item. This excavated material shall be paid for at the contract unit price per cubic yard. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid as unclassified excavation.

c. Over-break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the RPR. All over-break shall be graded or removed by the Contractor and disposed of as directed by the RPR. The RPR shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 Borrow excavation. Borrow areas are not required.

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating drainage ditches including intercepting, inlet, or outlet ditches; or other types as shown on the plans. The work shall be performed in sequence with the other construction. Ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be placed in designated waste areas or as directed by the RPR. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, the top 12 inches of subgrade shall be compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

152-2.6 Preparation of embankment area. All sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches and shall then be compacted per paragraph 152-2.10.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

152-2.8 Formation of embankments. The material shall be constructed in lifts as established in the control strip, but not less than 6 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the RPR. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each lift shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

The Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

The Contractor will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D 1557. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the Contractor for every 1,000 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

If the material has greater than 30% retained on the 3/4-inch sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.

Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. Under all areas to be paved, the embankments shall be compacted to a depth of 12" and to a density of not less than 100% of the maximum density as determined by ASTM D1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches] which shall be prepared for a seedbed in accordance with Item T-901

The in-place field density shall be determined in accordance with ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the

RPR for acceptance. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each lift is placed. Lift placement shall begin in the deepest portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

When rock, concrete pavement, asphalt pavement, and other embankment material are excavated at approximately the same time as the subgrade, the material shall be incorporated into the outer portion of the embankment and the subgrade material shall be incorporated under the future paved areas. Stones, fragmentary rock, and recycled pavement larger than 4 inches in their greatest dimensions will not be allowed in the top 12 inches of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the RPR and the finer material shall be used to fill the voids forming a dense, compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the RPR.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet in thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet below the finished subgrade.

152-2.9 Proof rolling. The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. After compaction is completed, the subgrade area shall be proof rolled with a 20 ton Tandem Axle Dùal Wheel Dump Truck loaded to the legal limit with tires inflated to 80/100/150 psi or a 20 ton Proof Roller with tires spaced not more than 32 inches on-center with tires inflated to 100/125/150 psi in the presence of the RPR. Apply coverage, as specified by the RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch or show permanent deformation greater than 1 inch shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth of 12 inches and to a density of not less than 100% of the maximum dry density as determined by ASTM D1557. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 12 inches and to a density of not less than 95% of the maximum density as determined by ASTM D1557.

The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the ¾ inch) sieve, follow the methods in ASTM D1557. Tests for moisture content and compaction will be taken at a minimum of 1,000 S.Y. of subgrade. All quality control testing shall be done by the Contractor. All quality assurance testing shall be done by the RPR.

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the

material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gage shall be field standardized daily.

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the RPR and the finished subgrade shall be maintained.

152-2.11 Finishing and protection of subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.

152-2.12 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage caused as a result of the Contractor's hauling operations shall be repaired at the Contractor's expense.

The Contractor shall be responsible for providing, maintaining and removing any haul roads or routes within or outside of the work area, and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining and removing haul roads or routes.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped, and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. **Smoothness.** The finished surface shall not vary more than +/- 1/2 inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. **Grade.** The grade and crown shall be measured on a 50-foot grid and shall be within +/-0.05 feet of the specified grade.

On safety areas, turfed areas and other designated areas within the grading limits where no subbase or base is to placed, grade shall not vary more than 0.10 feet from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the RPR, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

METHOD OF MEASUREMENT

152-3.1 Measurement for payment specified by the cubic yard shall be computed by the average end areas of design cross sections.

152-3.1 The quantity of unclassified excavation to be paid for shall be the number of cubic yards measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

152-3.2 Stockpiled material shall not be measured for payment in the stockpiled position.

BASIS OF PAYMENT

152-4.1 Unclassified excavation payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-152.1	Unclassified Excavation, Dispose Off Site - per cubic yard
Item P-152.2	Unclassified Excavation, Select Fill from On-Site Material - per cubic yard
Item P-152.3	Subgrade Preparation – per square yard
Item P-152.4	Unsuitable/Over Excavation – per cubic yard
Item P-152.5	Unclassified Excavation, Stockpile On-Site – per cubic yard

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T-180	Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 18-in. Drop

ASTM International (ASTM)

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Advisory Circulars (AC)

AC 150/5370-2	Operational Safety on Airports During Construction Software

Software

FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design

U.S. Department of Transportation

FAA RD-76-66	Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152

Item D-701 Pipe for Storm Drains and Culverts

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below. Underground piping and components used in drainage systems for terminal and aircraft fueling ramp drainage shall be noncombustible and inert to fuel in accordance with National Fire Protection Association (NFPA) 415.

701-2.2 Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C1840	Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe

701-2.3 Concrete. Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi at 28 days and conform to the requirements of ASTM C94.

701-2.4 Rubber gaskets. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443. Rubber gaskets for PVC pipe, polyethylene, and polypropylene pipe shall conform to the requirements of ASTM F477. Rubber gaskets for zinc-coated steel pipe and precoated galvanized pipe shall conform to the requirements of ASTM D1056, for the "RE" closed cell grades. Rubber gaskets for steel reinforced thermoplastic ribbed pipe shall conform to the requirements of ASTM F477.

701-2.5 Joint mortar. Pipe joint mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

701-2.6 Joint fillers. Poured filler for joints shall conform to the requirements of ASTM D6690.

701-2.7 Plastic gaskets. Plastic gaskets shall conform to the requirements of ASTM C990.

701-2.8. Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153. When CLSM is used, all joints shall have gaskets.

701-2.9 Precast box culverts. Manufactured in accordance with and conforming to ASTM C1433.

701-2.10 Precast concrete pipe. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than

the external diameter of the pipe plus 12 inches on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch or 1/2 inch for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade should be filled with granular material to form a uniform foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The RPR shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 Bedding. The bedding surface for the pipe shall provide a foundation of uniform density to support the pipe throughout its entire length.

a. Rigid pipe. The pipe bedding shall be constructed uniformly for the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 in when the bedding thickness is less than 6 inches, and 1-1/2 in when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed uncompacted material under the middle third of the pipe prior to placement of the pipe.

b. Flexible pipe. For flexible pipe, the bed shall be roughly shaped to fit the pipe, and a bedding blanket of sand or fine granular material shall be provided as follows:

Flexible Pipe Bedding

Pipe Corrugation Depth		Minimum Bedding Depth	
inch	**mm**	**inch**	**mm**
1/2	12	1	25
1	25	2	50
2	50	3	75
2-1/2	60	3-1/2	90

c. Other pipe materials. For PVC, polyethylene, polypropylene, or fiberglass pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of 3/4 inches. For pipes installed under paved areas, no more than 12% of the material shall pass the No. 200 sieve. For all other areas, no more than 50% of the material shall pass the No. 200 sieve. The bedding shall have a thickness of at least 6 inches below the bottom of the pipe and extend up around the pipe for a depth of not less than 50% of the pipe's vertical outside diameter.

701-3.3 Laying pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 Joining pipe. Joints shall be made with (1) cement mortar, (2) cement grout, (3) rubber gaskets, (4) plastic gaskets, (5) coupling bands.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

a. Concrete pipe. Concrete pipe may be either bell and spigot or tongue and groove. Pipe sections at joints shall be fully seated and the inner surfaces flush and even. Concrete pipe joints shall be sealed with rubber gaskets meeting ASTM C443 when leak resistant joints are required.

b. Metal pipe. Metal pipe shall be firmly joined by form-fitting bands conforming to the requirements of ASTM A760 for steel pipe and AASHTO M196 for aluminum pipe.

c. PVC, Polyethylene, or Polypropylene pipe. Joints for PVC, Polyethylene, or Polypropylene pipe shall conform to the requirements of ASTM D3212 when leak resistant joints are required. Joints for PVC and Polyethylene pipe shall conform to the requirements of AASHTO M304 when soil tight joints are required. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252 or ASTM M294. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764.

701-3.5 Embedment and Overfill. Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.

701-3.5-1 Embedment Material Requirements

a. Concrete Pipe. Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Types 1, 2, 3, or 4) per ASTM C1479. If a concrete cradle or CLSM embedment material is used, it shall conform to the plan details.

b. Plastic and fiberglass Pipe. Embedment material shall meet the requirements of ASTM D3282, A-1, A-2-4, A-2-5, or A-3. Embedment material shall be free of organic material, stones larger than 1.5 inches in the greatest dimension, or frozen lumps. Embedment material shall extend to 12 inches above the top of the pipe.

c. Metal Pipe. Embedment material shall be granular as specified in the contract document and specifications, and shall be free of organic material, rock fragments larger than 1.5 inches in the greatest dimension and frozen lumps. As a minimum, backfill materials shall meet the requirements of ASTM D3282, A-1, A-2, or A-3. Embedment material shall extend to 12 inches above the top of the pipe.

701-3.5-2 Placement of Embedment Material

The embedment material shall be compacted in layers not exceeding 6 inches on each side of the pipe and shall be brought up one foot above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the embedment material shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on each side of the pipe to one foot above the top of the pipe. All embedment material shall be compacted to a density required under Item P-152.

Concrete cradles and flowable fills, such as controlled low strength material (CLSM) or controlled density fill (CDF), may be used for embedment provided adequate flotation resistance can be achieved by restraints, weighing, or placement technique.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

701-3.6 Overfill

Pipes shall be inspected before any overfill is in place. Any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense. Evaluation of any damage to RCP shall be evaluated based on AASHTO R73.

Overfill material shall be place and compacted in layers as required to achieve compaction to at least 95 percent standard proctor per ASTM D1557. The soil shall contain no debris, organic matter, frozen material, or stones with a diameter greater than one half the thickness of the compacted layers being placed.

701-3.7 Inspection Requirements

An initial post installation inspection shall be performed by the RPR no sooner than 30 days after completion of installation and final backfill. Clean or flush all lines prior to inspection.

Incorporate specific inspection requirements for the various types of pipes beneath the general inspection requirements.

Reinforced concrete pipe shall be inspected, evaluated, and reported on in accordance with ASTM C1840, "Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe." Any issues reported shall include still photo and video documentation. The zoom ratio shall be provided for all still or video images that document any issues of concern by the inspection firm.

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet (m) of pipe in place, completed, and accepted. It shall be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The size of pipe shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured.

BASIS OF PAYMENT

701-5.0 These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

701-5.1 Payment will be made at the contract unit price per linear foot (meter) for 18 inch, Class V and 24", Class V concrete sewer pipe.

Payment will be made under:

Item D-701.1	Concrete Sewer Pipe 18 inch, Class V - per linear foot

Item D-701.2	Concrete Sewer Pipe 24 inch, Class V – per linear foot
Item D-701.3	Concrete Sewer Pipe 30 inch, Class V – per linear foot

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M167	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M190	Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M219	Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M243	Standard Specification for Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter

ASTM International (ASTM)

ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A761	Standard Specification for Corrugated Steel Structural Plate, Zinc Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A849	Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B745	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
ASTM C14	Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete

ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe
ASTM C655	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
ASTM C990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM D1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3262	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Sewer Pipe
ASTM D3282	Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D4161	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F667	Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR PR) Based on Outside Diameter
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

ASTM F2435	Standard Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
ASTM F2736	Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2764	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
ASTM F2881	Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

National Fire Protection Association (NFPA)

NFPA 415	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

END ITEM D-701

Item D-751 Manholes, Catch Basins, Inlets and Inspection Holes

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the RPR.

MATERIALS

751-2.1 Brick. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 Mortar. Mortar shall consist of one part Portland cement and two parts sand. The cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 Concrete. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 Precast concrete pipe manhole rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches nor more than 48 inches. There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole. Gaskets shall conform to the requirements of ASTM C443.

751-2.5 Corrugated metal. Corrugated metal shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M36.

751-2.6 Frames, covers, and grates. The castings shall conform to one of the following requirements:

a. ASTM A48, Class 35B: Gray iron castings

b. ASTM A47: Malleable iron castings

c. ASTM A27: Steel castings

d. ASTM A283, Grade D: Structural steel for grates and frames

e. ASTM A536, Grade 65-45-12: Ductile iron castings

f. ASTM A897: Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate 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 A123.

751-2.7 Steps. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of asphalt paint, when directed.

751-2.8 Precast inlet structures. Manufactured in accordance with and conforming to ASTM C913.

CONSTRUCTION METHODS

751-3.1 Unclassified excavation.

a. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the RPR. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the RPR may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or 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 RPR. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

d. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage finished masonry. The cost of removal shall be included in the unit price bid for the structure.

e. After excavation is completed for each structure, the Contractor shall notify the RPR. No concrete or reinforcing steel shall be placed until the RPR has approved the depth of the excavation and the character of the foundation material.

751-3.2 Brick structures.

a. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of reinforced concrete mixed, prepared, and placed in accordance with the requirements of Item P-610.

b. Laying brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it that can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and re-laid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.

c. Joints. All joints shall be filled with mortar at every course Exterior faces shall be laid up in advance of backing. Exterior faces shall be plastered or parged with a coat of mortar not less than 3/8 inch thick before the backing is laid up. Prior to parging, all joints on the back of face courses shall be cut flush. Unless otherwise noted, joints shall be not less than 1/4 inch nor more than 1/2 inch wide and the selected joint width shall be maintained uniform throughout the work.

d. Pointing. Face joints shall be neatly struck, using the weather-struck joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used, the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.

e. Cleaning. Upon completion of the work all exterior surfaces shall be thoroughly cleaned by scrubbing and washing with water. If necessary to produce satisfactory results, cleaning shall be done with a 5% solution of muriatic acid which shall then be rinsed off with liberal quantities of water.

f. Curing and cold weather protection. The brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost on the brick or when the air temperature is below 50°F unless the Contractor has, on the project ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 60°F for the duration of the curing period.

751-3.3 Concrete structures. Concrete structures which are to be cast-in-place within the project boundaries shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction 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 RPR before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped to the outlet.

751-3.4 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program.

Precast concrete structures shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall: (1) be smoothed to a uniform surface on both interior and exterior of the structure or (2) utilize a rubber gasket per ASTM C443. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal or metal encapsulated steps that are embedded or built into the side walls shall be aligned and placed in accordance to ASTM C478. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 Corrugated metal structures. Corrugated metal structures shall be prefabricated. All standard or special fittings shall be furnished to provide pipe connections or branches with the correct dimensions and of sufficient length to accommodate connecting bands. The fittings shall be welded in place to the metal structures. The top of the metal structure shall be designed so that either a concrete slab or metal collar may be attached to allow the fastening of a standard metal frame and grate or cover. Steps or ladders shall be furnished as shown on the plans. Corrugated metal structures shall be constructed on prepared foundations, conforming to the dimensions and locations as shown on the plans. When indicated, the structures shall be placed on a reinforced concrete base.

751-3.6 Inlet and outlet pipes. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 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 RPR and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the RPR. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.8 Installation of steps. The steps shall be installed as indicated on the plans or as directed by the RPR. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures, they shall meet the requirements of ASTM C478. The steps shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches.

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. For metal structures, the ladder shall be secured by welding the top support to the structure and grouting the bottom support into drilled holes in the foundation or as directed by the RPR.

751-3.9 Backfilling.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches in loose depth and compacted to the density required in Item P-152. Each layer shall be deposited evenly 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 RPR.

b. Backfill shall not be placed against any structure until approved by the RPR. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

c. Backfill shall not be measured for direct payment. Performance of this work shall be considered an obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as approved by the RPR. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 Manholes, catch basins, inlets, and inspection holes shall be measured by the unit.

BASIS OF PAYMENT

751-5.1 The accepted quantities of manholes, catch basins, inlets, and inspection holes will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes 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 D-751.1	Aircraft Ranted Manhole with Aircraft Rated Lid – per each
Item D-751.2	Airfield Inlet with Aircraft Rated Grate – per each
Item D-751.3	Adjust Storm Manhole/Inlet to Grade – per each
Item D-751.4	Connect Storm Sewer Pipe to Existing Storm Structure – per each
Item D-751.5	24" RCP & Manholes Miscellaneous Costs – per lump sum

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A897	Standard Specification for Austempered Ductile Iron Castings
ASTM C32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C913	Standard Specification for Precast Concrete Water and Wastewater Structures.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M36	Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

END OF ITEM D-751

Item L-108 Underground Power Cable for Airports

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables that are direct buried and furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. It includes excavation and backfill of trench for direct-buried cables only. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the RPR. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of cable for FAA owned/operated facilities.

EQUIPMENT AND MATERIALS

108-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program per AC 150/5345-53, current version.

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 RPR.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the RPR 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 products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be tabbed by specification section and electronically submitted in pdf format. The RPR reserves the right to reject any and all equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of 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. The Contractor shall maintain a minimum insulation resistance in accordance with paragraph 108-3.10e with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period when tested in

accordance with AC 150/5340-26, *Maintenance Airport Visual Aid Facilities*, paragraph 5.1.3.1, Insulation Resistance Test.

108-2.2 Cable. Underground cable for airfield lighting facilities (runway and taxiway lights and signs) shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits latest edition. Conductors for use on 6.6 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #8 American wire gauge (AWG), L-824 Type C, 5,000 volts, non-shielded, with cross-linked polyethylene insulation. Conductors for use on 20 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #6 AWG, L-824 Type C, 5,000 volts, non-shielded, with cross-linked polyethylene insulation. L-824 conductors for use on the L-830 secondary of airfield lighting series circuits shall be sized in accordance with the manufacturer's recommendations. All other conductors shall comply with FAA and National Electric Code (NEC) requirements. Conductor sizes noted above shall not apply to leads furnished by manufacturers on airfield lighting transformers and fixtures.

Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Commercial Item Description A-A-59544A and shall be type THWN-2, 75°C for installation in conduit and RHW-2, 75°C for direct burial installations. Conductors for parallel (voltage) circuits shall be type and size and installed in accordance with NFPA-70, National Electrical Code.

Unless noted otherwise, all 600-volt and less non-airfield lighting conductor sizes are based on a 75°C, THWN-2, 600-volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit/duct sizes are based on the use of THWN-2, 600-volt insulated conductors. The Contractor shall make the necessary increase in conduit/duct sizes for other types of wire insulation. In no case shall the conduit/duct size be reduced. The minimum power circuit wire size shall be #12 AWG.

Conductor sizes may have been adjusted due to voltage drop or other engineering considerations. Equipment provided by the Contractor shall be capable of accepting the quantity and sizes of conductors shown in the Contract Documents. All conductors, pigtails, cable step-down adapters, cable step-up adapters, terminal blocks and splicing materials necessary to complete the cable termination/splice shall be considered incidental to the respective pay items provided.

Cable type, size, number of conductors, strand and service voltage shall be as specified in the Contract Document.

108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for grounding bond wire per ASTM B3 and ASTM B8, and shall be bare copper wire . For voltage powered circuits, the equipment grounding conductor shall comply with NEC Article 250.

Ground rods shall be copper or copper-clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 10 feet long and 3/4 inch in diameter.

108-2.4 Cable connections. In-line connections or splices of underground primary cables shall be of the type called for on the plans and shall be one of the types listed below. No separate payment will be made for cable connections.

a. The cast splice. Not used.

b. The field-attached plug-in splice. Field attached plug-in splices shall be installed as shown on the plans. The Contractor shall determine the outside diameter of the cable to be spliced and furnish appropriately sized connector kits and/or adapters. Tape shall be in accordance with the manufacturer's requirements. Primary Connector Kits manufactured by Amerace, "Super Kit", Integro "Complete Kit", or approved equal is acceptable.

c. The factory-molded plug-in splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

d. The taped or heat-shrink splice. Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D4388 and the plastic tape should comply with Military Specification MIL-I-24391 or Commercial Item Description A-A-55809. Heat shrinkable tubing shall be heavy-wall, self-sealing tubing rated for the voltage of the wire being spliced and suitable for direct-buried installations. The tubing shall be factory coated with a thermoplastic adhesive-sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits that are designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

In all the above cases, connections of cable conductors shall be made using crimp connectors using a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made per the manufacturer's recommendations and listings.

All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except that a light base ground clamp connector shall be used for attachment to the light base. All exothermic connections shall be made per the manufacturer's recommendations and listings.

108-2.5 Splicer qualifications. Every airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 volts AC. The Contractor shall submit to the RPR proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

108-2.6 Concrete. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

108-2.7 Flowable backfill. Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

108-2.8 Cable identification tags. Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

108-2.9 Tape. Electrical tapes shall be Scotch™ Electrical Tapes –Scotch™ 88 (1-1/2 inch wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch wide), as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

108-2.10 Electrical coating. Electrical coating shall be Scotchkote™ as manufactured by 3M™, or an approved equivalent.

108-2.11 Existing circuits. Whenever the scope of work requires connection to an existing circuit, the existing circuit's insulation resistance shall be tested, in the presence of the RPR. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the RPR. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the RPR. The Contractor shall record the results on forms acceptable to the RPR. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the existing 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 test results shall be submitted in the Operation and Maintenance (O&M) Manual.

108-2.12 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend tape shall be polyethylene film with a metalized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item. Detectable warning tape for communication cables shall be orange. Detectable warning tape color code shall comply with the APWA Uniform Color Code.

CONSTRUCTION METHODS

108-3.1 General. The Contractor shall install the specified cable at the approximate locations indicated on the plans. Unless otherwise shown on the plans, all cable required to cross under pavements expected to carry aircraft loads shall be installed in concrete encased duct banks. Cable shall be run without splices, from fixture to fixture.

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

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed and on both sides of slack loops where a future connector would be installed.

Provide not less than 3 feet of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least one foot vertically above the top of the access structure. This requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the RPR.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch in size. The cable circuit identification shall match the circuits noted on the construction plans.

Removed cable, not called out as abandoned communication line, shall be incidental to the installation bid item.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. 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 per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

The Contractor shall make no connections or splices of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of

debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor's expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

The cable shall be installed in a manner that prevents harmful stretching of the conductor, damage to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape providing moisture-tight mechanical protection with minimum bulk, or alternately, heat shrinkable tubing 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 conduit, all cable shall be pulled in the conduit at the same time. The pulling of a cable through duct banks or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Maximum pulling tensions shall not exceed the cable manufacturer's recommendations. A non-hardening cable-pulling lubricant recommended for the type of cable being installed shall be used where required.

The Contractor shall submit the recommended pulling tension values to the RPR prior to any cable installation. If required by the RPR, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the RPR. Cable pull tensions shall be recorded by the Contractor and reviewed by the RPR. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor's expense.

The manufacturer's minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the RPR, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

Cable shall not be dragged across base can or manhole edges, pavement or earth. When cable must be coiled, lay cable out on a canvas tarp or use other appropriate means to prevent abrasion to the cable jacket.

108-3.3 Installation of direct-buried cable in trenches. Not used.

108-3.4 Cable markers for direct-buried cable. Not used.

108-3.5 Splicing. Connections of the type shown on the plans shall be made by experienced personnel regularly engaged in this type of work and shall be made as follows:

a. Cast splices. Not used.

b. Field-attached plug-in splices. These shall be assembled per the manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by the following method: roll-over water seal flap to sealing position on mating connector. wrapped with at least two layers of rubber or synthetic rubber tape and two layers of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint.

c. Factory-molded plug-in splices. These shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by the following method: roll-over water seal flap to sealing position on mating connector. wrapped with at least two layers of rubber or synthetic

rubber tape and two layers of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint .

d. Taped or heat-shrink splices. Not used.

e. Assembly. Surfaces of equipment or conductors being terminated or connected shall be prepared in accordance with industry standard practice and manufacturer's recommendations. All surfaces to be connected shall be thoroughly cleaned to remove all dirt, grease, oxides, nonconductive films, or other foreign material. Paints and other nonconductive coatings shall be removed to expose base metal. Clean all surfaces at least 1/4 inch (6.4 mm) beyond all sides of the larger bonded area on all mating surfaces. Use a joint compound suitable for the materials used in the connection. Repair painted/coated surface to original condition after completing the connection.

108-3.6 Bare counterpoise wire installation for lightning protection and grounding. If shown on the plans or included in the job specifications, bare solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables. The RPR shall select one of two methods of lightning protection for the airfield lighting circuit based upon sound engineering practice and lightning strike density.

a. Equipotential. The counterpoise size is as shown on the plans. The equipotential method is applicable to all airfield lighting systems, i.e. runway, taxiway, apron – touchdown zone, centerline, edge, threshold and approach lighting systems. The equipotential method is also successfully applied to provide lightning protection for power, signal and communication systems. The light bases, counterpoise, etc – all components - are bonded together and bonded to the vault power system ground loop/electrode.

Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables. The counterpoise is centered over the cable/conduit/duct to be protected.

The counterpoise conductor shall be installed no less than 8 inches (200 mm) minimum or 12 inches (300 mm) maximum above the raceway or cable to be protected, except as permitted below:

(1) The minimum counterpoise conductor height above the raceway or cable to be protected shall be permitted to be adjusted subject to coordination with the airfield lighting and pavement designs.

(2) The counterpoise conductor height above the protected raceway(s) or cable(s) shall be calculated to ensure that the raceway or cable is within a 45-degree area of protection, (45 degrees on each side of vertical creating a 90-degree angle).

The counterpoise conductor shall be bonded to each metallic light base, mounting stake, and metallic airfield lighting component.

All metallic airfield lighting components in the field circuit on the output side of the constant current regulator (CCR) or other power source shall be bonded to the airfield lighting counterpoise system.

All components rise and fall at the same potential, with no potential difference, no damaging arcing and no damaging current flow.

See AC 150/5340-30, Design and Installation Details for Airport Visual Aids and NFPA 780, Standard for the Installation of Lightning Protection Systems, Chapter 11, for a detailed description of the Equipotential Method of lightning protection.

Reference FAA STD-019E, Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment, Part 4.1.1.7..

b. Isolation. Not used this project.

c. Common Installation requirements. When a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

Nonmetallic light bases are not allowed.

Where raceway is installed by the directional bore, jack and bore, or other drilling method, the counterpoise conductor shall be permitted to be installed concurrently with the directional bore, jack and bore, or other drilling method raceway, **external to the raceway or sleeve**.

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet apart around the entire circuit. The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode-grounding system. The connections shall be made as shown on the plans and in the specifications.

Where an existing airfield lighting system is being extended or modified, the new counterpoise conductors shall be interconnected to existing counterpoise conductors at each intersection of the new and existing airfield lighting counterpoise systems.

d. Parallel Voltage Systems. Not used this project.

108-3.7 Counterpoise installation above multiple conduits and duct banks. Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete area of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete area of protection measured 45 degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

108-3.8 Counterpoise installation at existing duct banks. When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

108-3.9 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process or equivalent method accepted by the RPR. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the RPR, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

a. All slag shall be removed from welds.

b. Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer's installation directions for proper methods of bonding copper wire to the light base. See AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.10 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits before and after installation. The Contractor

shall perform all tests in the presence of the RPR. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the RPR. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

a. Earth resistance testing methods shall be submitted to the RPR for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the RPR. All such testing shall be at the sole expense of the Contractor.

b. Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The RPR shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the RPR the following:

c. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.

d. That all affected circuits (existing and new) are free from unspecified grounds.

e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than **500** megohms. Verify continuity of all series airfield lighting circuits prior to energization.

f. That the insulation resistance to ground of all new non-grounded conductors of new multiple circuits or circuit segments is not less than 100 megohms.

g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.

h. That all affected circuits (existing and new) 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.

i. That the impedance to ground of each ground rod does not exceed **25** ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the RPR prior to performing the testing.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the RPR. Where connecting new cable to existing cable, insulation resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved "repair" procedures for items that have failed testing other than complete replacement.

METHOD OF MEASUREMENT

108-4.1 The cost of all excavation, backfill, dewatering and restoration regardless of the type of material encountered shall be included in the unit price bid for the work.

108-4.2 Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet installed and grounding connectors, and trench marking tape ready for operation,

and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall not include additional quantities required for slack.

108-4.3 No separate payment will be made for ground rods.

108-4.4 Additional ground rods necessary to achieve the required impedance to ground reading shall be incidental to overall project.

BASIS OF PAYMENT

108-5.1 Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods, ground connectors, removed cable, and trench marking tape, necessary to complete this item.

Payment will be made under:

Item L-108.1	No. 6 AWG, Solid, Bare Copper Counterpoise Wire, Installed In Trench with Duct, Including Grounding Rods, Including Connections/Terminations - per linear foot
Item L-108.2	No. 8 AWG, 5 kV, L-824, Type C Cable, Installed in Trench, Duct Bank or Conduit - per liner foot
Item L-108.3	Remove Abandoned Communication Line – per linear foot
Item L-108.4	No. 6, 600V, XHHW Cable, Installed in Trench, Duct Bank or Conduit - per liner foot
Item L-108.5	No. 4, 600V, XHHW Cable – per linear foot
Item L-108.6	1/0 Bare Guard Wire – per linear foot

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
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
AC 150/5345-53	Airport Lighting Equipment Certification Program

Commercial Item Description

A-A-59544A	Cable and Wire, Electrical (Power, Fixed Installation)
A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

ASTM International (ASTM)

ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
ASTM D4388	Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes

Mil Spec

MIL-PRF-23586F	Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical
MIL-I-24391	Insulation Tape, Electrical, Plastic, Pressure Sensitive

National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)
NFPA-780	Standard for the Installation of Lightning Protection Systems

American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

Federal Aviation Administration Standard

FAA STD-019E	Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment

END OF ITEM L-108

Item L-110 Airport Underground Electrical Duct Banks and Conduits

DESCRIPTION

110-1.1 This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete or buried in sand) installed per this specification at the locations and per the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

EQUIPMENT AND MATERIALS

110-2.1 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 requested by the RPR.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the RPR and replaced with materials, that comply with these specifications, at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the RPR 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 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 made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be tabbed by specification section and electronically submitted in pdf format. The RPR reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes specified in this document.

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.

110-2.2 Steel conduit. Rigid galvanized steel (RGS) conduit and fittings shall be hot dipped galvanized inside and out and conform to the requirements of Underwriters Laboratories Standards 6, 514B, and 1242. All RGS conduits or RGS elbows installed below grade, in concrete, permanently wet locations or other similar environments shall be painted with a 10-mil thick coat of asphaltum sealer or shall have a factory-bonded polyvinyl chloride (PVC) cover. Any exposed galvanizing or steel shall be coated with 10 mils of asphaltum sealer. When using PVC coated RGS conduit, care shall be exercised not to damage the factory PVC coating. Damaged PVC coating shall be repaired per the manufacturer's written instructions. In lieu of PVC coated RGS, corrosion wrap tape shall be permitted to be used where RGS is in contact with direct earth."

110-2.3 Plastic conduit. Plastic conduit and fittings-shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high-density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 of the current National Electrical Code shall be one of the following, as shown on the plans:

a. Type I–Schedule 40 and Schedule 80 PVC suitable for underground use either direct-buried or encased in concrete.

b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

c. Type III – Schedule 80 PVC suitable for either above ground or underground use either direct-buried or encased in concrete.

d. Type III –HDPE pipe, minimum standard dimensional ratio (SDR) 11, suitable for placement with directional boring under pavement.

The type of solvent cement shall be as recommended by the conduit/fitting manufacturer.

110-2.4 Split conduit. Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.

110-2.5 Conduit spacers. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads. They shall be designed to accept No. 4 reinforcing bars installed vertically.

110-2.6 Concrete. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

110-2.7 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program. Precast concrete structures shall conform to ASTM C478.

110-2.8 Flowable backfill. Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

110-2.9 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) red (electrical power lines, cables, conduit and lighting cable), orange (telephone/fiber optic cabling) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches wide. Detectable tape is incidental to the respective bid item.

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The RPR shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, 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 bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. Under pavement, the top of the duct bank shall not be less than 18 inches below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches below finished grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed the light bases, manholes, pull boxes, etc., and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200-pound test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet.

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching

equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required conduit or duct bank 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. Flowable backfill may alternatively be used

Underground electrical warning (Caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall submit a sample of the proposed warning tape for approval by the RPR. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet.

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.

All excavation shall be unclassified and shall be considered incidental to Item L-110. Dewatering necessary for duct installation, and erosion per federal, state, and local requirements is incidental to Item L-110.

Unless otherwise specified, excavated materials that are deemed by the RPR to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the RPR and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables) cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

b. Trenching, etc., in cable areas shall then proceed with approval of the RPR, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 Duct banks. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet beyond the edges of the pavement or 3 feet beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches thick prior to its initial set. The Contractor shall space the conduits not less than 3 inches apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

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 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 pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches wide tape, 8 inches minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch wide tape only for single conduit runs. Utilize the 6-inch wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the RPR shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the RPR.

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches nor more than 12 inches wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, 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 conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport's secured area where trespassing is prohibited are at least 18 inches below the finished grade. Conduits outside the Airport's secured area shall be installed so that the tops of the conduits are at least 24 inches below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches apart (measured from outside wall to outside wall) in a horizontal direction and lot less than 6 inches apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

110-3.4 Markers. Not required.

110-3.5 Backfilling for conduits. For conduits, 8 inches of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 except that material used for back fill shall be select material not larger than 4 inches in diameter.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where 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 per instructions issued by the RPR.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfilling shall be select material not larger than 4 inches in diameter. In addition to the requirements of Item P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet of duct bank or one work period's construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where 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 per instructions issued by the RPR.

110-3.7 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include seeding and mulching shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. All restoration shall be considered incidental to the respective L-110 pay item. Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object

debris (FOD) and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and restoration, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for removal and disposal of existing duct banks and conduits as shown on the plans, 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 per the provisions and intent of the plans and specifications.

Payment will be made under:

Item L-110.1	Concrete Encased Electrical Duct Bank, 2W-2" - per linear foot
Item L-110.2	Concrete Encased Electrical Duct Bank, 4W-4" – per linear foot
Item L-110.3	Concrete Encased New Electrical Duct Bank, 4W-4" – per linear foot
Item L-110.4	Concrete Encased Conduit, 1W-2" Type II PVC – per linear foot
Item L-110.5	Non-Encased Electrical Conduit, 1W-2" Type II PVC - per linear foot
Item L-110.6	Split Conduit for FAA Cables – per linear foot
Item L-110.7	Lower Existing Home Run – per linear foot

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circular (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program

ASTM International (ASTM)

ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)

Underwriters Laboratories (UL)

UL Standard 6	Electrical Rigid Metal Conduit - Steel

UL Standard 514B	Conduit, Tubing, and Cable Fittings
UL Standard 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL Standard 1242	Electrical Intermediate Metal Conduit Steel
UL Standard 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL Standard 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110

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Edwin Scott

From: Malloy, Jason <jmalloy@indexc.com>
Sent: Monday, March 18, 2024 4:43 PM
To: Edwin Scott
Cc: awright@aulickengineering.com
Subject: RE: AGS - Taxiway G Draft CO #1
Attachments: AGS Dump Site - Topo 2024.01.18 - Original Ground.dxf; AGS Dump Site - Topo 2024.03.15 - Stockpile.dxf

Edwin,

See attached topo of the original ground at the dump site and topo from last week. Based on these topos, I was able to quantify 4,926 CY of dirt was placed in this area. Let me know if you need me to send these point files in a different file type for your use.

Thanks

From: Edwin Scott <Edwin.Scott@meadhunt.com>
Sent: Friday, March 8, 2024 9:28 AM
To: Malloy, Jason <jmalloy@indexc.com>
Cc: awright@aulickengineering.com
Subject: RE: AGS - Taxiway G Draft CO #1

Jason,

Let me review and I'll follow up if I have any questions.

Thanks,

Edwin Scott, JR., PE
Direct: 803-520-2986 | Cell: 803-261-4008 | Transfer Files
meadhunt.com | Experience Exceptional

From: Malloy, Jason <jmalloy@indexc.com>
Sent: Friday, March 8, 2024 8:22 AM
To: Edwin Scott <Edwin.Scott@meadhunt.com>
Cc: awright@aulickengineering.com
Subject: RE: AGS - Taxiway G Draft CO #1

Edwin,

See attached markups for quantity revisions on three line items.

1. Bid Alt 1 – P-152.4 Unsuitable/Over Excavation – I suggest only reducing this quantity by 4,500 CY instead of 5,500 CY. That will provide roughly 1,000 CY for the 60 day closure work area.

2. Bid Alt 1 – D-701.2 Concrete Sewer Pipe, 24-inch – Reduce the entire quantity of 89 LF
3. Bid Alt 1 New Work – D-701.3 Concrete Sewer Pipe, 30-inch – Quantity is actually 274 LF

I would also like to add the following line items to the New Work List:

Pay Schedule	Pay Item	Description	Original Quantity
Bid Alt 1	TBD	No. 4, 600V, XHHW Cable	0
Bid Alt 1	TBD	1/0 Bare Guard Wire	0
Base Bid	TBD	Lower Existing Home Run - IX Cost	0
Bid Alt 1	TBD	Purchase 24" RCP & Manholes, Shipping and Handling for 24" RCP & Manholes	0

These would add a total of $57,353 to the change order amount. Taking the total for the change order to $340,261.25.

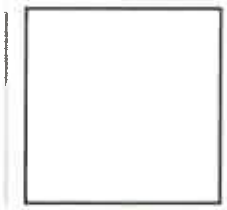
These extra work items have already been completed. Therefore, we would like to bill for them so, we can pay Trinity and Foley Precast.

Let me know if you have any questions.

Thanks

Jason Malloy
Senior Project Manager

Independence Excavating, Inc.
5720 E. Schaaf Rd. | Independence, OH 44131
O: 216.212.2056
E: jmalloy@indexc.com
www.indexc.com



From: Edwin Scott <Edwin.Scott@meadhunt.com>
Sent: Thursday, March 7, 2024 1:53 PM
To: Malloy, Jason <jmalloy@indexc.com>
Cc: awright@aulickengineering.com
Subject: AGS - Taxiway G Draft CO #1

Jason,

See attached for a draft CO#1. Please review and let me know if you have any comments or if I'm missing anything. This should be reflective of the quantities you were tracking as well as the most recent pay app.

One question regarding the 24" pipe. It looks like the 18" pipe removed from the project is replaced with 24"? I'm not aware of anywhere that we actually installed 24" pipe within the project as everything at the crossing was revised to be 30" pipe. I've talked to Andrew and he wasn't aware of any change either.

Also, we will need the surveyed quantities of the material stockpiled onsite. This isn't shown as everything is currently included in line items already in the project.

Thanks,

Edwin Scott, JR., PE
Project Manager | Aviation
Direct: 803-520-2986 | Cell: 803-261-4008 | Transfer Files
Mead&Hunt
LinkedIn | Facebook | Instagram

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AGS Taxiway G Project
Change Order Log

Pay Schedule	Pay Item	Description	Original Quantity	UOM	Actual Quantity	Delta Quantity	Unit Price	Price Change
Base Bid	P501.1	Reinforcement Change Order	0	LS	1	1	$ 69,309.00	$ 69,309.00
Bid Alt 1	P501.1	Reinforcement Change Order	0	LS	1	1	$ 158,989.50	$ 158,989.50
Bid Alt 1	D-701.1	18 inch RCP	231	LF	45	-186	$ 170.00	$ (31,620.00)
Bid Alt 1	D-701.2	24 inch RCP	89	LF	185	96	$ 200.00	$ 19,200.00
Bid Alt 1	TBD	30 inch RCP	0	LF	89	89	$ 250.00	$ 22,250.00
Bid Alt 1	P-620.5	Temporary Displaced Threshold	1	LS	0	-1	$ 125,000.00	$ (125,000.00)
Bid Alt 1	TBD	Split Conduit and Jacket Existing Direct Bury FAA Cables	0	LF	470	470	$ 92.50	$ 43,475.00
Base Bid	P-152.1	P152 Exc to Waste Overrun	3290	CY	19487	16197	$ 30.00	$ 485,910.00
Bid Alt 1	P-152.2	P152 Exc to Embank Overrun	2844	CY	7066	4222	$ 20.00	$ 84,440.00
Base Bid	P-152.4	P152 Unsuitable Exc Underrun	5000	CY	25	-4975	$ 28.00	$ (139,300.00)
Bid Alt 1	P-152.4	P152 Unsuitable Exc Underrun	10000	CY	4500	-5500	$ 28.00	$ (154,000.00)
	L-180.4	AWOS Additional Wire - Price TBD				0		
Base Bid	C-102.1a	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	11754	LF	4168	-7586	$ 4.00	$ (30,344.00)
Bid Alt 1	C-102.1a	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	11754	LF	4168	-7586	$ 4.00	$ (30,344.00)
Base Bid	C-102.1b	Construct, Maintain, and Remove Inlet Sediment Trap	48	EA	9	-39	$ 350.00	$ (13,650.00)
Bid Alt 1	C-102.1b	Construct, Maintain, and Remove Inlet Sediment Trap	48	EA	0	-48	$ 350.00	$ (16,800.00)
Bid Alt 1	C-102.1c	Construct, Maintain, and Remove Construction Exit	1	EA	0	-1	$ 12,000.00	$ (12,000.00)
Base Bid	C-102.1f	Emergency Erosion Control Mobe	1	LS	0	-1	$ 2,500.00	$ (2,500.00)
Bid Alt 1	C-102.1f	Emergency Erosion Control Mobe	1	LS	0	-1	$ 2,500.00	$ (2,500.00)
Base Bid	P-101.1	Full Depth Asphalt Pavement Removal	1972	SY	1829	-143	$ 30.00	$ (4,290.00)
Base Bid	P-101.2	Cold Milling	233	SY	0	-233	$ 20.00	$ (4,660.00)
Base Bid	P-620.2	Temporary Pavement Markings	9393	SF	0	-9393	$ 1.10	$ (10,332.30)
Bid Alt 1	P-620.2	Temporary Pavement Markings	30223	SF	0	-30223	$ 0.65	$ (19,644.95)
Base Bid	T-901.3	Seed Staging Area	1	AC	0	-1	$ 2,300.00	$ (2,300.00)
Bid Alt 1	T-901.3	Seed Staging Area	1	AC	0	-1	$ 2,300.00	$ (2,300.00)
Base Bid	T-905.2	Topsoil Staging Area	2762	CY	0	-2762	$ 8.00	$ (22,096.00)
Bid Alt 1	T-905.2	Topsoil Staging Area	2762	CY	0	-2762	$ 7.00	$ (19,334.00)
		Total Price Change Amount						**$ 240,558.25**
		Original Contract Amount						**$ 11,877,051.10**
		Revised Contract Amount						**$ 12,117,609.35**

February 12, 2024

Elizabeth Giles
Senior Construction Project Manager
Augusta Region Airport
1501 Aviation Way
Augusta, GA 30906

Project: Construct Taxiway G
Augusta Regional Airport

Subject: Price Proposal – AWOS Feeder
SL# IX-AGS-03

Dear Mrs. Giles,

Independence Excavating Inc. (IX) is pleased to submit this proposal in response to the direction provided in RFI 09 regarding the electrical scope for the AWOS equipment. There is additional quantity associated with Bid Alt 1 Pay Item L-108.4 (No. 6, 600V, XHHW). This item will overrun approximately 1,200 LF over the original quantity of 1,612 LF. There is also scope called for on plan sheets E-203 and E-205 that does not currently have Pay Items provided. These two scopes of work are: No. 4, 600V, XHHW Cable and 1/0 Bare Guard Wire. These two items' quantities and unit prices are shown in the table below along with the 1,200 LF quantity overrun of the existing No. 6, 600V, XHHW cable item.

Bid Schedule	Pay Item	Description	Quantity	UOM	Unit Price	Total Price
Bid Alt 1	L-108.4	No. 6, 600V, XHHW Cable	1200	LF	$ 4.25	$ 5,100.00
Bid Alt 1	TBD	No. 4, 600V, XHHW Cable	2400	LF	$ 9.79	$ 23,496.00
Bid Alt 1	TBD	1/0 Bare Guard Wire	550	LF	$ 12.24	$ 6,732.00
Total Change Amount						**$ 35,328.00**

If you require additional information, please do not hesitate to contact me.

Sincerely,

Jason Malloy
Senior Project Manager
Independence Excavating Inc.

AUGUSTA REGIONAL AIRPORT

(706) 798-3236 • Fax: (706) 798-1551 • 1501 Aviation Way • Augusta, Georgia 30906 • www.flyags.com

February 20, 2024

Mr. Richard M. DiGeronimo, Vice President
Cc: Jason Malloy, Project Manager
Independence Excavating, Inc.
5720 E. Schaaf Rd.
Independence, OH 44131

Subject: Construct Taxiway G / Apron G

Dear Mr. DiGeronimo:

I am in receipt of your proposal. Please accept this correspondence as Augusta Regional Airport's assumption of financial responsibility, in the amount of $228,298.50, for the change order associated with the additional steel dowels and reinforcement along the concrete shoulders.

We appreciate the work you have done thus far and look forward to the scheduled completion of this project. If you have additional questions, I can be reached at 706-796-4040.

Sincerely,

Herbert L. Judon, Jr., A.A.E, IAP
Executive Director

cc:
Jason Malloy, Independence Excavating, Inc.
Elizabeth Giles, Augusta Regional Airport

Change Order Proposal
Additional Shoulder Reinforcement and Dowel Bar Size Change

Base Bid

Change Order Quantity Takeoff and Pricing						Current Contract Quantity & Unit Price				Proposed Contract Quantity & Unit Price			
Bid Item	Description	Quantity	Unit	Unit Price	Total Price	Quantity	Unit	Unit Price	Total Price	Quantity	Unit	Unit Price	Total Price
P501.1	Shoulder Reinforcement: Type E - Doweled Construction Joint	1,522.0	LF	$21.00	$31,962.00	15,402.0	SY	$145.00	$2,233,290.00	15,402.0	SY	$149.50	$2,302,599.00
P501.1	Shoulder Reinforcement: Wire Mesh Reinforced Panels	583.0	SY	$45.00	$26,235.00								
P501.1	Additional Cost for 1.25" x 20" Bar	6,600.0	EA	$1.35	$8,910.00								
Total Lump Sum Change Order Amount					$67,107.00				$67,107.00				$2,302,599.00
						Original Contract Amount + Change Order Amount			$2,300,397.00			Proposed Change Order Amount	$69,309.00

Bid Alt 1

Change Order Quantity Takeoff and Pricing						Current Contract Quantity & Unit Price				Proposed Contract Quantity & Unit Price			
Bid Item	Description	Quantity	Unit	Unit Price	Total Price	Quantity	Unit	Unit Price	Total Price	Quantity	Unit	Unit Price	Total Price
P501.1	Shoulder Reinforcement: Type E - Doweled Construction Joint	3,825.0	LF	$21.00	$80,325.00	35,331.0	SY	$105.00	$3,709,755.00	35,331.0	SY	$109.50	$3,868,744.50
P501.1	Shoulder Reinforcement: Wire Mesh Reinforced Panels	1,271.0	SY	$45.00	$57,195.00								
P501.1	Additional Cost for 1.25" x 20" Bar	15,400.0	EA	$1.35	$20,790.00								
Total Lump Sum Change Order Amount					$158,310.00				$158,310.00				$3,868,744.50
						Original Contract Amount + Change Order Amount			$3,868,065.00			Proposed Change Order Amount	$158,989.50

Combined Total Lump Sum Change Order Amount	$225,417.00

Combined Proposed Change Order Amount	$228,298.50

Augusta Regional Airport
Construct Taxiway G/Apron G

Progress Payment Application: CCO #1
For Period Ending: 28 Mar 2024

CCO No.	Spec.	Description	Unit of Issue	Quantity	Unit Price	Extended Price	Approved Quantity	Approved Amount	Quantity to Date	Amount to Date
BASE BID										
1	C-102.1a	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	LF	-7,586	$ 4.00	$ (30,344.00)	0.00	$ -	0.00	$ -
1	C-102.1b	Construct, Maintain, and Remove Inlet Sediment Trap	EA	-39	$ 350.00	$ (13,650.00)	0.00	$ -	0.00	$ -
1	C-102.1f	Emergency Erosion Control Mobilization	LS	-1	$ 2,500.00	$ (2,500.00)	0.00	$ -	0.00	$ -
1	P-101.1	Full Depth Asphalt Pavement Removal	SY	-143	$ 30.00	$ (4,290.00)	0.00	$ -	0.00	$ -
1	P-101.2	Cold Milling	SY	-233	$ 20.00	$ (4,660.00)	0.00	$ -	0.00	$ -
1	P-152.1	Unclassified Excavation, Remove Off-Site	CY	3,930	$ 30.00	$ 117,900.00	0.00	$ -	1,843.00	$ 55,290.00
1	P-152.4	Unsuitable/Over Excavation	CY	-4,975	$ 28.00	$ (139,300.00)	0.00	$ -	0.00	$ -
1	P-152.5	Unclassified Excavation, Stockpile On-Site	CY	0	$ 20.00	$ -	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	-15,402	$ 145.00	$ (2,233,290.00)	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	15,402	$ 149.50	$ 2,302,599.00	0.00	$ -	0.00	$ -
1	P-620.2	Temporary Pavement Markings	SF	-9,393	$ 1.10	$ (10,332.30)	0.00	$ -	0.00	$ -
1	T-901.3	Seeding Staging Area	AC	-1	$ 2,300.00	$ (2,300.00)	0.00	$ -	0.00	$ -
1	T-905.2	Topsoil Staging Area	CY	-2,762	$ 8.00	$ (22,096.00)	0.00	$ -	0.00	$ -
1	L-110.7	Lower Existing Home Run	LF	125	$ 29.00	$ 3,625.00	0.00	$ -	0.00	$ -
		BASE BID SUBTOTAL				**$ (38,638.30)**		**$ -**		**$ 55,290.00**
BID ALT 1										
1	C-102.1a	Installation, Maintenance, and Removal of Silt Fence or Silt Sock	LF	-7,586	$ 4.00	$ (30,344.00)	0.00	$ -	0.00	$ -
1	C-102.1b	Construct, Maintain, and Remove Inlet Sediment Trap	EA	-48	$ 350.00	$ (16,800.00)	0.00	$ -	0.00	$ -
1	C-102.1c	Construct, Maintain, and Remove Construction Exit	EA	-1	$ 12,000.00	$ (12,000.00)	0.00	$ -	0.00	$ -
1	C-102.1f	Emergency Erosion Control Mobilization	LS	-1	$ 2,500.00	$ (2,500.00)	0.00	$ -	0.00	$ -
1	P-152.1	Unclassified Excavation, Remove Off-Site	CY	7,341	$ 30.00	$ 220,230.00	0.00	$ -	0.00	$ -
1	P-152.2	Unclassified Excavation, Select Fill from On-Site Material	CY	4,222	$ 20.00	$ 84,440.00	0.00	$ -	0.00	$ -
1	P-152.4	Unsuitable/Over Excavation	CY	-4,500	$ 28.00	$ (126,000.00)	0.00	$ -	0.00	$ -
1	P-152.5	Unclassified Excavation, Stockpile On-Site	CY	4,926	$ 20.00	$ 98,520.00	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	-35,331	$ 105.00	$ (3,709,755.00)	0.00	$ -	0.00	$ -
1	P-501.1	Portland Cement Concrete Pavement (14")	SY	35,331	$ 109.50	$ 3,868,744.50	0.00	$ -	0.00	$ -
1	P-620.2	Temporary Pavement Markings	SF	-30,223	$ 0.65	$ (19,644.95)	0.00	$ -	0.00	$ -
1	P-620.5	Temporary Displaced Threshold	LS	-1	$ 125,000.00	$ (125,000.00)	0.00	$ -	0.00	$ -
1	D-701.1	Concrete Sewer Pipe, 18-inch, Class V	LF	-186	$ 170.00	$ (31,620.00)	0.00	$ -	0.00	$ -
1	D-701.2	Concrete Sewer Pipe, 24-inch, Class V	LF	-89	$ 200.00	$ (17,800.00)	0.00	$ -	0.00	$ -
1	D-701.3	Concrete Sewer Pipe, 30-inch, Class V	LF	274	$ 250.00	$ 68,500.00	0.00	$ -	0.00	$ -
1	D-751.5	24" RCP & Manholes Misc. Costs	LS	1	$ 23,500.00	$ 23,500.00	0.00	$ -	0.00	$ -
1	T-901.3	Seeding Staging Area	AC	-1	$ 2,300.00	$ (2,300.00)	0.00	$ -	0.00	$ -
1	T-905.2	Topsoil Staging Area	CY	-2,762	$ 7.00	$ (19,334.00)	0.00	$ -	0.00	$ -
1	L-108.4	No. 6, 600V, XHHW Cable	LF	1,200	$ 4.25	$ 5,100.00	0.00	$ -	0.00	$ -
1	L-108.5	No. 4, 600V, XHHW Cable	LF	2,400	$ 9.79	$ 23,496.00	0.00	$ -	0.00	$ -
1	L-108.6	1/0 Bare Guard Wire	LF	550	$ 12.24	$ 6,732.00	0.00	$ -	0.00	$ -
1	L-110.6	Split Conduit for FAA Cables	LF	470	$ 92.50	$ 43,475.00	0.00	$ -	0.00	$ -
		BID ALT 1 SUBTOTAL				**$ 329,639.55**		**$ -**		**$ -**
		CHANGE ORDER 1 TOTAL				**$ 291,001.25**		**$ -**		**$ 55,290.00**
		PROJECT TOTAL				**$ 291,001.25**		**$ -**		**$ 55,290.00**
					Subtotal	#REF!		$0.00		$0.00