

**SPECIFICATIONS
FOR
RUNWAY 18R PAPI INSTALLATION**

**FREDERICK W. SMITH INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE**



MSCAA PROJECT NO. 25-1486-01

DATED: 08/17/2026

ISSUED FOR BID

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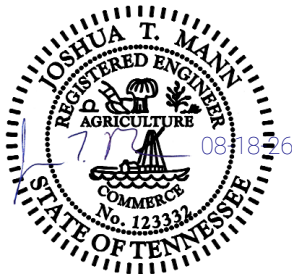
08/17/2026

TECHNICAL SPECIFICATIONS – ISSUED FOR BID/CONSTRUCTION

I hereby certify that Specifications A-102, C-102, C-105, P-152, P-208, P-605, P-610, T-904, and T-905 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee

Joshua T. Mann

Date 08/17/2026 Reg. No. 123332



TECHNICAL SPECIFICATIONS – ISSUED FOR BID/CONSTRUCTION

I hereby certify that Specifications L-100, L-108, L-110, L-115, and L-125 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee

Vincent E. Ricevuto

Date 08/17/2026 Reg. No. 109193



**Frederick W. Smith International Airport (MEM)
Runway 18R PAPI Installation**



TECHNICAL SPECIFICATIONS

Item	Description
C-102	Temporary Air and Water Pollution, Soil Erosion, and Siltation Control
C-105	Mobilization
A-102	Construction Access, Project Safety and Security, and Maintenance of Traffic
P-152	Excavation, Subgrade, and Embankment
P-208	Aggregate Base Course
P-605	Joint Sealants for Pavements
P-610	Concrete for Miscellaneous Structures
T-904	Sodding
T-905	Topsoil
L-100	Electric Work General Provisions and Requirements
L-108	Underground Power Cable for Airports
L-110	Airport Underground Electrical Duct Banks and Conduits
L-115	Electrical Manholes and Junction Structures
L-125	Installation of Airport Lighting Systems

Attachment 1 Construction Safety and Phasing Plan (CSPP)

Attachment 2 Safety Plan Compliance Document (SPCD)

Item C-102 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

102-1. This item shall consist of temporary control measures as shown on the plans or as ordered by the Resident Project Representative (RPR) during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

102-2.1 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant. Seed mix shall be as follows:

Seed	Quantity (% by Weight)
Kentucky 31 Fescue	70
Bermuda Grass	10
Westerwold Ryegrass	20

Application Rate: 1.5lbs per 1,000SF. The seed mix referenced above shall be used after trenching for the conduits have been backfilled.

Unless otherwise directed, all disturbed areas shall be restored with sod.

102-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

102-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

102-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

102-2.5 Silt fence. Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

102-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the RPR before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

102-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The RPR shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

102-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the RPR.

102-3.3 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The RPR shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the RPR.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the RPR. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the RPR, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The RPR may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

102-3.4 Installation, maintenance and removal of silt fence. Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the RPR.

102-3.4a Installation, maintenance and removal of Filter Sock Check Dam. Install and remove TDOT filter sock check dams adjacent to the Glide Slope Shelter access drive. These check dams shall be installed as needed to control runoff from construction at the glide slope shelter. Installation shall be per the detail on Sheet CG501.

METHOD OF MEASUREMENT

102-4.1 Temporary erosion and pollution control work required will be performed as scheduled or directed by the RPR.

a. Erosion Control for the project shall be a Lump Sum payment

102-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

BASIS OF PAYMENT

102-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the RPR and measured as provided in paragraph 102-4.1 will be paid for under:

Item C-102-5.1 Erosion Control – Lump Sum

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the RPR will be paid for in accordance with Section 90, paragraph 90-05 *Payment for Extra Work*.

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 150/5200-33 *Hazardous Wildlife Attractants on or Near Airports*

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

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM C-102

Item C-105 Mobilization

105-1 Description. This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-2 Mobilization limit. Mobilization shall be limited to 10 percent of the total project cost.

105-3 Posted notices. No Posted Notices are required for this project.

105-4 Engineer/RPR field office. An Engineer/RPR field office is not required.

METHOD OF MEASUREMENT

105-5 Basis of measurement and payment. Mobilization will be paid in full with the first pay request.

BASIS OF PAYMENT

105-6 Payment will be made under:

Item C-105-6.1 Mobilization – 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.

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

END OF ITEM C-105

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Item A-102 Construction Access, Project Safety and Security, and Maintenance of Traffic

DESCRIPTION

102-1.1 General

- A. Parts of this project takes place within the Air Operations Area (AOA) of an active airfield; therefore, access to the site must be controlled at all times. The access points are shown in the safety and phasing plans.
- B. All vehicles accessing the project site on behalf of the Contractor shall enter through the access points indicated on the Plans. The AOA access point for this project is Gate CD-9.
- C. The Contractor shall coordinate access and security within the AOA with the RPR.
- D. The security gate shall remain closed and locked except when vehicles are entering or exiting.
- E. Escort personnel, vehicles, and radio equipment shall be trained, badged and subject to approval by MSCAA.
- F. The Contractor shall insure that all AOA pavements, which are open to traffic, are continuously kept clean and free of debris of any kind. Vehicular haul roads shall also be kept clean. All costs shall be considered incidental to the Project.
- G. Contractor must be able to remove debris from active airfield and haul route pavements that results from construction activity. Contractor shall use appropriate methods and equipment necessary to remove the debris.
- H. The Contractor shall review and make themselves familiar with the Construction Safety and Phasing Plan (CSPP) and shall follow the requirements contained within. The CSPP is incorporated in Attachment 1 in the contract documents.
- I. The Contractor shall review and make themselves familiar with the AC 150/5370-2G Safety Plan Compliance Document (SPCD) worksheet for airport projects and shall follow the requirements contained within. The Contractor shall fill out the SPCD and submit the document 14 days prior to the pre-construction conference. The notice-to-proceed cannot be issued without approval of the document. The Construction Project Daily Safety Inspection Checklist within must be filled out daily. The SPCD is incorporated in Attachment 2 the contract documents.

102-1.2 Gate Operations. RPR and MSCAA security will provide AOA access through gate CD-9. Contractor shall coordinate work/shift schedule in 72-hrs in advance of starting the work. Each day, contractor shall call MSCAA communications desk at 901-922-8298 about 30 minutes prior desired access to AOA at Gate CD-9. MSCAA security will then drive to the gate to let contractor into Gate CD-9. Contractor to call same number to be let out of Gate CD-9 at the end of the work day. Access requests outside of the schedule will be accommodated, but cannot guarantee response time.

Gate CD-9A is a non-AOA Gate located along the perimeter road just west of Gate CD-9A. MSCAA will provide a lock to the Contractor for Gate CD-9A. Contractor must keep CD-9A

locked at all times when not in use.

102-1.3 Security and Escorts. The Contractor will provide badged personnel with non-movement area driving privileges and vehicles to escort Contractor, sub-contractor, vendor and delivery vehicles and equipment from the security gate to the project site. All work shall be coordinated with MSCAA Project Engineer. A minimum of 72 hrs notice shall be provided to the MSCAA Project Engineer for site access.

Contractor's vehicles, including Sub-Contractors vehicles must be inspected and receive an airfield access sticker. This will allow these vehicles unrestricted access only on the Project site. Vendors and delivery vehicles (dump trucks, concrete trucks, and materials deliveries) must be escorted to their specific area on the site. Once at the project site, the Contractor shall be responsible to provide badged personnel to assume control of the escorted vehicle and non-badged personnel. Such vehicles may not transit back to the gate without an escort.

The Contractor shall meet all MSCAA security requirements with regard to training and wearing badges, and/or being escorted by authorized personnel approved by the MSCAA Project Engineer.

102-1.4 Fencing. The Contractor shall maintain the existing AOA security fencing and gates surrounding the Contractor Staging Area if applicable until the completion of the Project.

102-1.5 Airfield Low Profile Barricade. Not used.

102-1.6 Airfield Medium Profile Barricade. Not Used.

102-1.6a Traffic Cones. 18" tall traffic cones shall be used at the Taxiway M connecting taxiways for the Runway 18R-36L closures. The orange cones shall have a 10 lb weighted base, and two (2) white reflective collars.

102-1.6b Orange Safety Fence. Orange construction safety fence shall be installed at the locations shown on the phasing plans to delineate certain segments of the runway safety area, runway object free area, and the Contractor's staging area south of the glide slope shelter. See Sheet SP002 for orange safety fence detail, and Sheets SP101 and SP102 for locations.

102-1.7 Maintenance of Traffic. The Contractor shall maintain public roadways in a clean swept condition at all times. Any debris deposited on the public roads by the Contractor, Sub-Contractors or supplier vehicles shall be removed immediately. Any debris deposited on the airport perimeter road by the Contractor, Sub-Contractors or supplier vehicles shall be removed immediately. A water truck, broom truck, vacuum truck or other equipment as approved by the MSCAA Project Engineer shall be made available for this purpose. All costs associated with maintaining clean public roadways shall be considered incidental to the project.

The Contractor shall install signs and traffic control devices meeting the requirements of the Manual of Uniform Traffic Control Devices, TDOT Standards and FAA Publications about construction on Airports when and whereas directed by the MSCAA Project Engineer or the TDOT.

The Contractor shall furnish and install all necessary cones for the necessary closures of the Taxiway M connecting taxiways between Runway 18R-36L and Taxiway M during the Runway 18R-36L closures. The Contractor shall install the MSCAA-provided Lighted 'X's at each end of Runway 18R-36L at the start of each Runway 18R-36L closure, and remove the Lighted 'X's at the end of each Runway 18R-36L closure. The Contractor is responsible for the maintenance of the Lighted 'X's (including necessary fueling) throughout the duration of the project.

102-1.8 Access Road and Staging Area. The Contractor shall repair and/or re-construct the access road and the staging area to repair any damage during construction. Repair methods shall be approved by the

MSCAA Project Engineer prior to completion. All disturbed areas shall be restored to their original condition, with sod, prior to the completion of the project.

METHOD OF MEASUREMENT

102-2.1 Construction Access, Project Security, and Staging Area. The method of measurement for Construction Access, Project Security, and Staging Area shall be paid for as a lump sum in accordance with paragraph 102-2.5.

102-2.2 Airfield Low Profile Barricade. Not used.

102-2.3 Airfield Medium Profile Barricade. Not used.

102-2.4 Maintenance of Traffic. The method of measurement for Maintenance of Traffic shall be paid for as a lump sum in accordance with paragraph 102-2.5.

102-2.5 Basis of Measurement and Payment. Based upon the contract lump sum price for the items above, partial payments will be allowed as follows:

- a. With first pay request, 25%.
- b. When 25% or more of the original contract is earned, an additional 25%.
- c. When 50% or more of the original contract is earned, an additional 40%.
- d. After Final Inspection, Staging area clean-up and delivery of all Project Closeout materials, the final 10%.

BASIS OF PAYMENT

102-3.1 Construction Access, Project Security, and Staging Area. Basis of payment shall be made at the contract lump sum price for Construction Access, Project Security, and Traffic Control. The price shall be full compensation escorting vehicles onto the site, badging, orange safety fence, vehicle stickers & inspection, labor, materials, tools, and incidentals necessary to complete this item.

102-3.2 Maintenance of Traffic. Basis of payment shall be made at the contract lump sum price for Maintenance of Traffic. The price shall be full compensation for providing all equipment (traffic cones noted previously in this section), installing and removing the MSCAA-provided lighted 'X's for the runway closures, maintaining the MSCAA-provided lighted 'X's, labor, and materials, and incidentals necessary to complete this item.

Payment will be made under:

- Item A-102.1 Construction Access, Project Security, and Staging Area – per lump sum
- Item A-102.2 Maintenance of Traffic – per lump sum

END OF ITEM A-102

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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 which is not otherwise classified and paid for under one of the following items.

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. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed in accordance with Item P-151.

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 (100 mm), to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) 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 may be requested by 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 0.04 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 (per cubic meter) for

unsuitable excavation. 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 (60 cm) 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 95% 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 (150 mm) 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 (300 mm) 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 (300 mm) 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 (150 mm) nor more than 12 inches (300 mm) 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 $\pm 2\%$ 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 RPR 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 D1557. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the RPR for every 3000 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 (19.0 mm) 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 95% of maximum density for non-cohesive soils, and 90% 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 inches and to a density of not less than 95% percent 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 2 inches which shall be prepared for a seedbed in accordance with Item T-904.

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. The RPR shall perform all quality assurance density tests while the Contractor is responsible for quality control testing. 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 (100 mm) in their greatest dimensions will not be allowed in the top 12 inches (300 mm) 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 (60 cm) 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 (1.2 m) below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in lifts, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items.

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. Before the start of base course installation, the subgrade area shall be proof rolled with a 20-ton Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 100 psi in the presence of the RPR. Apply a minimum of 1 coverage, or 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 (25 mm) or show permanent deformation greater than 1 inch (25 mm) 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 24 inches and to a density of not less than 95 percent 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 90 percent of the maximum density as determined by ASTM D1557.

The material to be compacted shall be within $\pm 2\%$ 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 $\frac{3}{4}$ inch (19.0 mm) sieve, follow the methods in ASTM D1557. Tests for moisture

content and compaction will be taken at a minimum of 1 test per 2,000 S.Y. of subgrade. 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 (75 mm), 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 $\pm \frac{1}{2}$ inch (12 mm) when tested with a 12-foot (3.7-m) 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 (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.
- b. **Grade.** The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within ± 0.05 feet (15 mm) of the specified grade.

On safety areas, turfed areas and other designated areas within the grading limits where no subbase or base is to be placed, grade shall not vary more than 0.10 feet (30 mm) 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.

METHOD OF MEASUREMENT

152-3.1 Unclassified Excavation, Borrow Excavation, Subgrade Preparation, and compaction for duct banks, foundations, and other installations shall be considered incidental to the cost of the items in which they are required.

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 a 457-mm (18-in.) Drop
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ASTM International (ASTM)

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
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ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
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ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2700 kN-m/m ³))
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ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
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Advisory Circulars (AC)

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

FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design

Frederick W. Smith International Airport (MEM)
Runway 18R PAPI Installation

MSCAA Project # 25-1486-01
Foth #0026M300.25

U.S. Department of Transportation

FAA RD-76-66

Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152

Item P-208 Aggregate Base Course

DESCRIPTION

208-1.1 This item shall consist of a base course composed of course aggregate bonded with fine aggregate base. It shall be constructed on a prepared subgrade or subbase course per these specifications and shall conform to the dimensions and typical cross-section shown on the plans.

MATERIALS

208-2.1 Aggregate base. The aggregate base material shall consist of both fine and coarse aggregate. Material shall be clean, sound, durable particles and fragments of stone or gravel, crushed stone, or crushed gravel mixed or blended with sand, screenings, or other materials. Materials shall be handled and stored in accordance with all federal, state, and local requirements. The aggregate shall be free from clay lumps, organic matter, or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as nearly constant and uniform as practicable. The fine aggregate portion, defined as the portion passing the No. 4 (4.75 mm) sieve produced in crushing operations, shall be incorporated in the base material to the extent permitted by the gradation requirements. Aggregate base material requirements are listed in the following table.

Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 50% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 60% by weight of particles with at least two fractured faces and 75% with at least one fractured face ¹	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles ²	ASTM D4791
Fine Aggregate		
Liquid limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

¹ The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

² A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

208-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances for Contractor's Final Gradation ¹ Percent
2 inch (50 mm)	--		±0
1-1/2 inch (37.5 mm)	100		±5
1 inch (25.0 mm)	70-100		±8
3/4 inch (19.0 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 (425 µm)	10-30		±5
No. 200 (75 µm)	5-15		±3

- 1 The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

208-2.3 Sampling and testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraphs 208-2.1 and 208-2.2. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 208-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

208-2.4 Separation Geotextile. Not used.

CONSTRUCTION METHODS

208-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the 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 (300 mm) 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 continue 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 by the RPR.

208-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the RPR before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the

Contractor's expense, may be required by the RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

208-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 208-3.5, the approved material may be transported directly to the placement.

208-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course layer shall be constructed in lifts as established in the control strip, but not less than 4 inches (100 mm) nor more than 12 inches (300 mm) 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 at the Contractor's expense.

208-3.5 Compaction. Immediately upon completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **ASTM D698**. The moisture content of the material during placing operations shall be within ± 2 percentage points of the optimum moisture content as determined by **ASTM D698**. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

208-3.6 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F (4°C) and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

208-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at their expense.

208-3.8 Surface tolerances. After the course has been compacted, 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 (75 mm), reshaped and recompact to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch (9 mm) when tested with a 12-foot (3.7-m) 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 (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

208-3.9 Acceptance sampling and testing. Aggregate base course shall be accepted for density and thickness on an area basis. Two tests will be made for density and thickness for each 1200 square yard. Sampling locations will be determined on a random basis per ASTM D3665.

a. Density. The RPR shall perform all density tests.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per **ASTM D698**. The in-place field density shall be determined per 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. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

b. Thickness. Depth tests shall be made by test holes at least 3 inches (75 mm) in diameter that extend through the base. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR for each area. Where the thickness is deficient by more than 1/2-inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

METHOD OF MEASUREMENT

208-4.1 Aggregate base course shall be considered incidental to the cost of the PCC bid items.

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 C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m 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 (2700 kN-m/m ³))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4643	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
American Association of State Highway and Transportation Officials (AASHTO)	
M288	Standard Specification for Geosynthetic Specification for Highway Applications

END OF ITEM P-208

Item P-605 Joint Sealants for Pavements

DESCRIPTION

605-1.1 This item shall consist of providing and installing a resilient and adhesive joint sealing material capable of effectively sealing joints in pavement; joints between different types of pavements; and cracks in existing pavement.

MATERIALS

605-2.1 Joint sealants. Joint sealant materials shall meet the requirements of ASTM D5893.

Each lot or batch of sealant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, the safe heating temperature, and shall be accompanied by the manufacturer's certification stating that the sealant meets the requirements of this specification.

605-2.2 Backer rod. The material furnished shall be a compressible, non-shrinking, non-staining, non-absorbing material that is non-reactive with the joint sealant in accordance with ASTM D5249. The backer-rod material shall be $25\% \pm 5\%$ larger in diameter than the nominal width of the joint.

605-2.3 Bond breaking tapes. Provide a bond breaking tape or separating material that is a flexible, non-shrinkable, non-absorbing, non-staining, and non-reacting adhesive-backed tape. The material shall have a melting point at least 5°F (3°C) greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The bond breaker tape shall be approximately 1/8 inch (3 mm) wider than the nominal width of the joint and shall not bond to the joint sealant.

CONSTRUCTION METHODS

605-3.1 Time of application. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F (10°C) and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint.

605-3.2 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

a. Tractor-mounted routing tool. Provide a routing tool, used for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

b. Concrete saw. Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified.

c. Sandblasting equipment. The Contractor must demonstrate sandblasting equipment including the air compressor, hose, guide and nozzle size, under job conditions, before approval in accordance with paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the Resident Project Representative (RPR), that the method cleans the joint and does not damage the joint.

d. Waterblasting equipment. The Contractor must demonstrate waterblasting equipment including the pumps, hose, guide and nozzle size, under job conditions, before approval in accordance with paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the RPR, that the method cleans the joint and does not damage the joint.

e. Hand tools. Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces. Hand tools should be carefully evaluated for potential spalling effects prior to approval for use.

f. Cold-applied, single-component sealing equipment. The equipment for installing ASTM D5893 single component joint sealants shall consist of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. The dimension of the nozzle shall be such that the tip of the nozzle will extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Small hand-held air-powered equipment (i.e., caulking guns) may be used for small applications.

605-3.3 Preparation of joints. Pavement joints for application of material in this specification must be dry, clean of all scale, dirt, dust, curing compound, and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method cleans the joint and does not damage the joint.

a. Sawing. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.

b. Sealing. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, filler, protrusions of hardened concrete, old sealant and other foreign material from the sides and upper edges of the joint space to be sealed. Cleaning shall be accomplished by sandblasting or waterblaster as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch (12 mm) from the joint edge shall be sandblasted clean. Sandblasting shall be accomplished in a minimum of two passes. One pass per joint face with the nozzle held at an angle directly toward the joint face and not more than 3 inches (75 mm) from it. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave them completely free of debris and water. The joint faces shall be surface dry when the seal is applied.

c. Backer Rod. When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a backer rod in accordance with paragraph 605-2.2 to prevent the entrance of the sealant below the specified depth. Take care to ensure that the backer rod is placed at the specified depth and is not stretched or twisted during installation.

d. Bond-breaking tape. Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond-separating tape breaker in accordance with paragraph 605-2.3 to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Securely bond the tape to the bottom of the joint opening so it will not float up into the new sealant.

605-3.4 Installation of sealants. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the RPR before sealing is allowed. Sealants shall be installed in accordance with the following requirements:

Immediately preceding, but not more than 50 feet (15 m) ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to 1/4 inch $\pm$ 1/16 inch below the top of pavement surface; or bottom of groove for grooved pavement. Remove and discard excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the RPR. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

605-3.5 Inspection. The Contractor shall inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified at no additional cost to the airport.

605-3.6 Clean-up. Upon completion of the project, remove all unused materials from the site and leave the pavement in a clean condition.

METHOD OF MEASUREMENT

605-4.1 Joint sealing shall be considered incidental to the cost of the PCC bid items.

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 D789	Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)
ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5893	Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt
ASTM D7116	Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types for Portland Cement Concrete Pavements

Advisory Circulars (AC)

AC 150/5340-30

Design and Installation Details for Airport Visual Aids

END ITEM P-605

Item P-610 Concrete for Miscellaneous Structures

DESCRIPTION

610-1.1 This item shall consist of concrete and reinforcement, as shown on the plans, prepared and constructed in accordance with these specifications. This specification shall be used for all concrete other than airfield pavement which are cast-in-place.

MATERIALS

610-2.1 General. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. Materials may be subject to inspection and tests at any time during their preparation or use. The source of all materials shall be approved by the Resident Project Representative (RPR) before delivery or use in the work. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to ensure preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed in them.

The use of pit-run aggregates shall not be permitted unless the pit-run aggregate has been screened and washed, and all fine and coarse aggregates stored separately and kept clean. The mixing of different aggregates from different sources in one storage stockpile or alternating batches of different aggregates shall not be permitted.

a. Reactivity. Fine aggregate and coarse aggregates to be used in all concrete shall have been tested separately within six months of the project in accordance with ASTM C1260. Test results shall be submitted to the RPR. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.08% at 14 days (16 days from casting). If the expansion either or both test specimen is greater than 0.08% at 14 days, but less than 0.20%, a minimum of 25% of Type F fly ash, or between 40% and 55% of slag cement shall be used in the concrete mix.

If the expansion is greater than 0.20%, the aggregates shall not be used, and test results for other aggregates must be submitted for evaluation; or aggregates that meet P-501 reactivity test requirements may be utilized.

610-2.2 Coarse aggregate. The coarse aggregate for concrete shall meet the requirements of ASTM C33 and the requirements of Table 4, Class Designation 5S; and the grading requirements shown below, as required for the project.

Coarse Aggregate Grading Requirements

Maximum Aggregate Size	ASTM C33, Table 3 Grading Requirements (Size No.)
1 1/2 inch (37.5 mm)	467 or 4 and 67
1 inch (25 mm)	57
3/4 inch (19 mm)	67
1/2 inch (12.5 mm)	7

610-2.2.1 Coarse Aggregate susceptibility to durability (D) cracking. Not used.

610-2.3 Fine aggregate. The fine aggregate for concrete shall meet all fine aggregate requirements of ASTM C33.

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 Type 1 or ASTM C595 Type IP, IS, or IL.

610-2.5 Cementitious materials.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the RPR.

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

610-2.6 Water. Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

610-2.7 Admixtures. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the RPR may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the RPR from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures shall not be used.

c. Other chemical admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by the RPR. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

610-2.8 Premolded joint material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751.

610-2.9 Joint filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.10 Steel reinforcement. Reinforcing shall consist of

Steel Reinforcement

Reinforcing Steel	ASTM A615, ASTM A706, ASTM A775, ASTM A934
Welded Steel Wire Fabric	ASTM A1064, ASTM A884
Welded Deformed Steel Fabric	ASTM A1064
Bar Mats	ASTM A184 or ASTM A704

610-2.11 Materials for curing concrete. Curing materials shall conform to ASTM C309.

CONSTRUCTION METHODS

610-3.1 General. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified here. All machinery and equipment used by the Contractor on the work, shall be of sufficient size to meet the requirements of the work. All work shall be subject to the inspection and approval of the RPR.

610-3.2 Concrete Mixture. The concrete shall develop a compressive strength of 4000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cementitious material per cubic yard (280 kg per cubic meter). The water cementitious ratio shall not exceed 0.45 by weight. The air content of the concrete shall be 5% +/- 1.2% as determined by ASTM C231 and shall have a slump of not more than 4 inches (100 mm) as determined by ASTM C143.

610-3.3 Mixing. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C94 or ASTM C685.

The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (4°C) without the RPRs approval. If approval is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his expense.

Retempering of concrete by adding water or any other material is not permitted.

The rate of delivery of concrete to the job shall be sufficient to allow uninterrupted placement of the concrete.

610-3.4 Forms. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the RPR. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as shown on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes. The Contractor shall be responsible for their adequacy.

The internal form ties shall be arranged so no metal will show in the concrete surface or discolor the surface when exposed to weathering when the forms are removed. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied immediately before the concrete is placed. Forms shall be constructed so they can be removed without injuring the concrete or concrete surface.

610-3.5 Placing reinforcement. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concrete placement. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.6 Embedded items. Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.

610-3.7 Concrete Consistency. The Contractor shall monitor the consistency of the concrete delivered to the project site; collect each batch ticket; check temperature; and perform slump tests on each truck at the project site in accordance with ASTM C143.

610-3.8 Placing concrete. All concrete shall be placed during daylight hours, unless otherwise approved. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the RPR. Concrete shall be placed as soon as practical after mixing, but in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet (1.5 m). Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation.

610-3.9 Vibration. Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309R, Guide for Consolidation of Concrete.

610-3.10 Joints. Joints shall be constructed as indicated on the plans.

610-3.11 Finishing. All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface struck-off with a straightedge and floated.

610-3.12 Curing and protection. All concrete shall be properly cured in accordance with the recommendations in American Concrete Institute (ACI) 308R, Guide to External Curing of Concrete. The concrete shall be protected from damage until project acceptance.

610-3.13 Cold weather placing. When concrete is placed at temperatures below 40°F (4°C), follow the cold weather concreting recommendations found in ACI 306R, Cold Weather Concreting.

610-3.14 Hot weather placing. When concrete is placed in hot weather greater than 85°F (30 °C), follow the hot weather concreting recommendations found in ACI 305R, Hot Weather Concreting.

QUALITY ASSURANCE (QA)

610-4.1 Quality Assurance sampling and testing. Concrete for each day's placement will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The RPR will sample the concrete in accordance with ASTM C172; test the slump in accordance with ASTM C143; test air content in accordance with ASTM C231; make and cure compressive strength specimens in accordance with ASTM C31; and test in accordance with ASTM C39. The QA testing agency will meet the requirements of ASTM C1077.

The Contractor shall provide adequate facilities for the initial curing of cylinders.

610-4.2 Defective work. Any defective work that cannot be satisfactorily repaired as determined by the RPR, shall be removed and replaced at the Contractor's expense. Defective work includes, but is not limited to, uneven dimensions, honeycombing and other voids on the surface or edges of the concrete.

METHOD OF MEASUREMENT

610-5.1 Concrete for the 6" pavement pad around the PAPI foundations shall be measured by the number square yards based on the dimensions shown on the plans. Concrete for the PAPI Foundations shall be measured per each foundation installed. Concrete for the PAPI PCA Rack foundation shall be considered incidental to the cost of the PAPI PCA Rack Bid Item. *Reinforcing and joint steel will not be measured separately. Inclusion of reinforcement and joint steel to be considered incidental to these items.*

BASIS OF PAYMENT

610-6.1a Payment shall be made at the contract price by the number of square yards installed for the 6" pavement pad around the PAPI foundations. Payment shall be made at the contract price per each for the PAPI Foundation installed. This price shall be full compensation for furnishing all materials including reinforcement and embedded items and for all preparation, delivery, installation, and curing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Concrete for the PAPI PCA rack shall be considered incidental to the cost of the PAPI PCA Rack bid item, and no separate payment shall be made. All costs for furnishing all materials including reinforcement and embedded items and for all preparation, delivery, installation, and curing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item shall be considered incidental to the PAPI PCA rack and PAPI support system bid item.

b. Payment. Payment shall be made under:

Item P-601-6.1a	6" PCC PAD around PAPIs – per square yard
Item P-601-6.1b	4' x 6' PCC PAPI Foundation – per each

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 A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete

ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157	Standard Performance Specification for Hydraulic Cement
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1365	Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

American Concrete Institute (ACI)

ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 308R	Guide to External Curing of Concrete
ACI 309R	Guide for Consolidation of Concrete

END OF ITEM P-610

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Item T-904 Sodding

DESCRIPTION

904-1.1 This item shall consist of furnishing, hauling, and placing approved live sod on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the RPR.

MATERIALS

904-2.1 Sod. Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of the species stated in the special provisions, and any vegetation more than 6 inches (150 mm) in height shall be mowed to a height of 3 inches (75 mm) or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions.

904-2.2 Lime. Lime shall be ground limestone containing not less than 85% of total carbonates, and shall be ground to such fineness that 90% will pass through a No. 20 (850 μ m) mesh sieve and 50% will pass through a No. 100 (150 μ m) mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 4,000 lb/acre. All liming materials shall conform to the requirements of ASTM C602.

904-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified, and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
- b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
- c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be commercial fertilizer and shall be spread at the rate of the manufacturer's recommendation.

904-2.4 Water. The water shall be sufficiently free from oil, acid, alkali, salt, or other harmful materials that would inhibit the growth of grass.

904-2.5 Soil for repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the RPR before being placed.

CONSTRUCTION METHODS

904-3.1 General. Areas to be solid, strip, or spot sodded shall be shown on the plans. Areas requiring special ground surface preparation such as tilling and those areas in a satisfactory condition that are to remain undisturbed shall also be shown on the plans.

Suitable equipment necessary for proper preparation of the ground surface and for the handling and placing of all required materials shall be on hand, in good condition, and shall be approved by the RPR before the various operations are started. The Contractor shall demonstrate to the RPR before starting the various operations that the application of required materials will be made at the specified rates.

904-3.2 Preparing the ground surface. After grading of areas has been completed and before applying fertilizer and limestone, areas to be sodded shall be raked or otherwise cleared of stones larger than 2 inches (50 mm) in any diameter, sticks, stumps, and other debris which might interfere with sodding, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes occurs after grading of areas and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

904-3.3 Applying fertilizer and ground limestone. Following ground surface preparation, fertilizer shall be uniformly spread at a rate which will provide not less than the minimum quantity of each fertilizer ingredient, as stated in the special provisions. If use of ground limestone is required, it shall then be spread at a rate that will provide not less than the minimum quantity stated in the special provisions. These materials shall be incorporated into the soil to a depth of not less than 2 inches (50 mm) by discing, raking, or other suitable methods. Any stones larger than 2 inches (50 mm) in any diameter, large clods, roots, and other litter brought to the surface by this operation shall be removed.

904-3.4 Obtaining and delivering sod. After inspection and approval of the source of sod by the RPR, the sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than 2 inches (50 mm). Sod sections or strips shall be cut in uniform widths, not less than 10 inches (250 mm), and in lengths of not less than 18 inches (0.5 m), but of such length as may be readily lifted without breaking, tearing, or loss of soil. Where strips are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stacked, kept moist, and protected from exposure to the air and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is too dry, approval to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

904-3.5 Laying sod. Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the RPR, provided the sod bed is watered to moisten the soil to a depth of at least 4 inches (100 mm) immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitch forks shall not be used to handle sod, and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to

edge and with staggered joints, in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment to provide a true and even surface, and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further displacement. Screened soil of good quality shall be used to fill all cracks between sods. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil in the sod after compaction shall be set approximately one inch (25 mm) below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On slopes steeper than one (1) vertical to 2-1/2 horizontal and in v-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than 12 inches (300 mm) in length and have a cross-sectional area of not less than 3/4 sq inch (18 sq mm). The pegs shall be driven flush with the surface of the sod.

904-3.6 Watering. Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface.

904-3.7 Establishing turf. The Contractor shall provide general care for the sodded areas as soon as the sod has been laid and shall continue until final inspection and acceptance of the work. All sodded areas shall be protected against traffic or other use by warning signs or barricades approved by the RPR. The Contractor shall mow the sodded areas with approved mowing equipment, depending upon climatic and growth conditions and the needs for mowing specific areas. Weeds or other undesirable vegetation shall be mowed and the clippings raked and removed from the area.

904-3.8 Repairing. When the surface has become gullied or otherwise damaged during the period covered by this contract, the affected areas shall be repaired to re-establish the grade and the condition of the soil, as directed by the RPR, and shall then be sodded as specified in paragraph 904-3.5.

METHOD OF MEASUREMENT

904-4.1 This item shall be measured on the basis of the area in square yards of the surface covered with sod and accepted.

BASIS OF PAYMENT

904-5.1 This item will be paid for on the basis of the contract unit price per square yard (square meter) for sodding, which price shall be full compensation for all labor, equipment, material, staking, and incidentals necessary to satisfactorily complete the items as specified.

Payment will be made under:

Item T-904-5.1	Sodding - per square yard
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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.

Frederick W. Smith International Airport (MEM)
Runway 18R PAPI Installation

MSCAA Project # 25-1486-01
Foth #0026M300.25

ASTM International (ASTM)

ASTM C602 Standard Specification for Agricultural Liming Materials

Advisory Circulars (AC)

AC 150/5200-33 Hazardous Wildlife Attractants on or Near Airports

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-904

Item T-905 Topsoil

DESCRIPTION

905-1.1 This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the RPR.

MATERIALS

905-2.1 Topsoil. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches (50 mm) or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed, but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh (75 μ m) sieve as determined by the wash test in accordance with ASTM C117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

905-2.2 Inspection and tests. Within 10 days following acceptance of the bid, the RPR shall be notified of the source of topsoil to be furnished by the Contractor. The topsoil shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor may be required to take representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in paragraph 905-2.1.

CONSTRUCTION METHODS

905-3.1 General. Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the RPR before the various operations are started.

905-3.2 Preparing the ground surface. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the

RPR, to a minimum depth of 2 inches (50 mm) to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches (50 mm) in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

905-3.3 Obtaining topsoil. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the RPR. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the RPR. The topsoil shall be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the RPR. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoil purposes, shall be removed and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the airport site, the Contractor shall locate and obtain the supply, subject to the approval of the RPR. The Contractor shall notify the RPR sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

905-3.4 Placing topsoil. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 2 inches (50 mm) after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turving operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches (50 mm) or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the RPR. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

METHOD OF MEASUREMENT

905-4.1 Stripping the existing topsoil, stockpiling the existing topsoil, and respreading the topsoil at the time of the sodding installation shall be incident to the Sodding bid item.

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 C117	Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing
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Advisory Circulars (AC)

AC 150/5200-33	Hazardous Wildlife Attractants on or Near Airports
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FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-905

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Item L-100 Electrical Work General Provisions and Requirements

DESCRIPTION

100-1.1 APPLICATION. These special provisions shall apply for electrical work. Where the contract special conditions or general provisions also apply, the stricter of the requirements shall apply.

100-1.2 RELATED SPECIFICATIONS.

- a. Item L-108 Underground Power Cable for Airports
- b. Item L-110 Airport Underground Electrical Duct Banks and Conduits
- c. Item L-115 Electrical Manholes and Junction Structures
- d. Item L-125 Installation of Airport Lighting Systems

100-1.2 AUXILIARIES AND ACCESSORIES. Include all auxiliaries and accessories for a complete and properly operating system, to the satisfaction of the Owner, RPR, and Engineer.

Provide and install all electrical systems and any necessary appurtenances as per FAA Advisory Circulars, NEC and local codes whether specified or shown on drawings or not. The content of these specifications and contract documents in general only refers to work required above and beyond the requirements of the FAA Advisory Circulars, NEC and applicable local codes.

The Electrical Contractor shall comply with all requirements of the State in which the work is performed. This shall include but not be limited to State Electrician Licensing requirements and journeyman/apprentice requirements as set forth in State laws.

100-1.3 PROJECT PAY ITEMS. Project pay items provided are inclusive of all work specifically identified as being included in the respective pay item by the Contract Documents. Unless otherwise noted, work identified with a specific pay item is required to complete the project and shall be incidental to the cost of that identified project pay item.

Where the Contract Documents establish a separate bid item for work that may otherwise be described as incidental or included under another specification section, the separate bid item shall govern and the work shall be measured and paid under that separate bid item. No work shall be measured or paid under more than one bid item.

100-1.4 CODES & REFERENCES. All electrical work shall be completed in accordance with the latest edition of the following publications, codes, guidelines, standards, and related or referenced documents. Comply with all regulations of governing Federal, State, County, local and other applicable codes, including the Utilities Company.

- a. FAA – Federal Aviation Administration
 - 1. Advisory Circulars
 - (https://www.faa.gov/regulations_policies/advisory_circulars/)
 - i. 150/5300-13 Airport Design
 - ii. 150/5340-18 Standards for Airport Sign Systems
 - iii. 150/5340-26 Maintenance of Airport Visual Aid Facilities
 - iv. 150/5340-30 Design and Installation Details for Airport Visual Aids
 - v. 150/5370-2 Operational Safety on Airports During Construction
 - vi. All Other Applicable and Referenced Advisory Circulars

2. Engineering Briefs
(https://www.faa.gov/airports/engineering/engineering_briefs/)
 - i. EB 83 In-Pavement Light Fixture Bolts
 - ii. EB 98 Infrared Specifications for Aviation Obstruction Light Compatibility with Night Vision Goggles (NVGs)
 - iii. All Other Applicable and Referenced Engineering Briefs
3. Orders (https://www.faa.gov/regulations_policies/orders_notices/)
 - i. 6000.204 Airway Facilities Maintenance Program
 - ii. 6750.16 Siting Criteria for Instrument Landing Systems
 - iii. 6850.2C Visual Guidance Lighting System
 - iv. 6950.22 Maintenance and testing guidance for power cable systems
 - v. JO 3900.64A Air Traffic Organization Electrical Safety Program
 - vi. All Other Applicable and Referenced Orders
4. FAA Standards (<https://www.faa.gov/airports/engineering>)
 - i. FAA STD-019G – Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
 - ii. FAA-C-1217H – Electrical Work, Premises Wiring
 - iii. FAA-C-139F – Airport Certification
 - iv. All Other Applicable FAA Standards
- b. NFPA – National Fire Protection Association**
 1. NFPA 70 – National Electrical Code (NEC)
 2. NFPA 70E – Standard for “Electrical Safety in the Workplace”
 3. NFPA 72 – National Fire Alarm Code
 4. NFPA 101 – Life Safety Code
 5. NFPA 780 - Standard for the Installation of Lightning Protection Systems
 6. All Other Applicable Codes
- c. NECA – National Electrical Contractors' Association**
- d. NETA – National Electrical Testing Association**
- e. NEMA – National Electrical Manufacturers' Association**
- f. IEEE – The Institute of Electrical and Electronic Engineers**
- g. IEEE C2 / NESC – National Electrical Safety Code**
- h. ANSI – American National Standards Institute**
- i. IES – Illuminating Engineering Society**
 1. RP 37-15
- j. OSHA – Occupational Safety and Health Administration**
 1. 29 CFR 1910 Occupational Safety and Health Standards
 2. 29 CFR 1926 Safety and Health Regulations for Construction
 3. All Other Applicable OSHA Regulations
- k. ICEA – Insulated Cable Engineers Association**
- l. NIST (NBS) – National Bureau of Standards**
- m. EPA – U.S. Environmental Protection Agency**
- n. UL – Underwriters' Laboratories, Inc**
- o. FS – Federal Specifications**
- p. International Electrical Testing Association.**
- q. AWS – American Welding Society**
 1. D1.1 Structural Welding Code
- r. IPRF – Innovative Pavement Research Foundation**
- s. ADA - American Disabilities Act**
- t. Electrical Utility Guidelines**
- u. State and local building codes**
- v. All other applicable standards and codes not listed**

The Contractor is responsible for obtaining and using the latest edition of the referenced standards. This list is not all inclusive but is offered as a convenience to the Contractor.

Where requirements of the contract documents are in excess of the above code requirements, the contract documents shall govern. The latest edition shall be the most recent publication date in effect as of the date of the advertisement for bids, except when a specific publication date is specified.

ABBREVIATIONS

Ø	-	Diameter
#	-	Number
#/C	-	Conductors per Cable (1/C = 1 Conductor/Cable)
A, AMP	-	Ampere(s)
ABAN	-	Abandon / Abandoned
AC	-	Alternating Current
AC	-	FAA Advisory Circular
ACP	-	Asphaltic Concrete Pavement (Flexible Pavement)
AHJ	-	Authority Having Jurisdiction
AIC	-	Ampere Symmetrical Interrupting Capacity RMS
AEIC	-	Association of Edison Illuminating Companies
AF	-	Ampere Frame
AFF	-	Above Finished Floor
AFG	-	Above Finished Grade
AFL	-	Airfield Lighting
AGL	-	Above Ground Level
AL	-	Aluminum
ALCS	-	Airfield Lighting Control System
ALCMS	-	Airfield Lighting Control and Monitoring System
AVL	-	Airfield Lighting Vault
ANSI	-	American National Standards Institute
AOA	-	Aircraft Operations Area
APPROX	-	Approximate
ARFF	-	Aircraft Rescue and Firefighting
ASTM	-	American Society for Testing and Materials
AT	-	Ampere Trip
ATS	-	Automatic Transfer Switch
AWG	-	American Wire Gauge
AUX	-	Auxiliary
BFG	-	Below Finished Grade
BGL	-	Below Ground Level
BIT	-	Bituminous
BLDG	-	Building
BSDC	-	Bare Soft Drawn Copper
C	-	Conduit
CB	-	Circuit Breaker
CCR	-	Constant Current Regulator
CKT	-	Circuit
℄, CL	-	Centerline
CLSM	-	Controlled Low Strength Material (Flowable Fill)
CLG	-	Ceiling
CMIL	-	Circular Mil (Area of Circle with Ø of 0.001")

C/N	-	Catalog Number
CO	-	Contracting Officer
COMM-		Communication
CONC	-	Concrete
COPS	-	Critical Operations Power Systems
CP	-	Counterpoise
CT	-	Current Transformer
CU	-	Copper
DC	-	Direct Current
DDC	-	Direct Digital Control
DEB	-	Direct Earth Buried
DEMARC		Demarcation
Demo	-	Demolish
DISC	-	Disconnect
DIST	-	Distribution
DIA, Ø	-	Diameter
DWG	-	Drawing
E:	-	Easting
ECB	-	Enclosed Circuit Breaker
EES	-	Earth Electrode System
E.G.	-	Exempli Gratia, "For Example"
EGC	-	Equipment Grounding Conductor
EL	-	Elevation
ELEC	-	Electrical
ELEV	-	Elevation
EM	-	Emergency
EMI	-	Electromagnetic Interference
EMER	-	Emergency
EMT	-	Electric Metallic Tube Conduit
EOP	-	Edge of (Aircraft Rated) Pavement
EQ	-	Equally Spaced
EQUIP	-	Equipment
ERGL	-	Elevated Runway Guard Lights
ETC	-	Etcetera, "And Other Similar Things", "And So Forth"
ETR	-	Existing To Remain
EX	-	Existing
EXIST	-	Existing
FA	-	Fire Alarm
FAA	-	Federal Aviation Administration
FLA	-	Full Load Amps
FMC	-	Flexible Metallic Conduit
FO	-	Fiber Optic
FOD	-	Foreign Object Debris/Damage
FREQ	-	Frequency
G, GND		Ground
GEC	-	Grounding Electrode Conductor
GFCI	-	Ground Fault Circuit Interrupter
GFGI	-	Government Furnished, Government Installed
GFI	-	Ground Fault Circuit Interrupter
GRS	-	Galvanized Rigid Steel
GS	-	Glide Slope (NAVAID)

HACR	-	Heating, Air Conditioning, And Refrigeration
HH	-	Handhole
HMI	-	Human Machine Interface
HP	-	Horsepower
HT	-	Height
HZ	-	Hertz
ICAO	-	International Civil Aviation Organization
ICEA	-	The Insulating Cable Engineers Association
I.E.	-	Id Est, "In Other Words"
IEEE	-	Institute of Electrical and Electronic Engineers
IES	-	Illuminating Engineering Society
ILS	-	Instrument Landing System
IMC	-	Intermediate Metal Conduit
INV	-	Invert Elevation
IP	-	Ingress Protection (Number Indicates Rating)
IP	-	Intersection Point
IRGL	-	In-Pavement Runway Guard Lights
IRMS	-	Insulation Resistance Monitoring System
ISO	-	Isolation
JB	-	Junction Box
JCB	-	Junction Can Plaza
KAIC	-	1,000 Ampere Symmetrical Interrupting Capacity RMS
KCMIL	-	1,000 Circular Mils (MCM)
KV	-	Kilovolt
KVA	-	Kilovolt-Amperes
KVAR	-	Kilovolt-Amperes Reactive
KW	-	Kilowatts
KWH	-	Kilowatt-Hour
LED	-	Light Emitting Diode
LF	-	Linear Feet
LIR	-	Low-Impact Resistance
LT	-	Left Offset
LFMC	-	Liquid Tight Flexible Metallic Conduit
LOC	-	Localizer (NAVAID)
LS	-	Lump Sum
LTG	-	Lighting
MAX	-	Maximum
MC	-	Metal Clad Cable
MCA	-	Minimum Circuit Ampacity
MCB	-	Main Circuit Breaker
MDP	-	Main Distribution Panel
MECH	-	Mechanical
MH	-	Manhole
MIN	-	Minimum
MISC	-	Miscellaneous
MLO	-	Main Lugs Only
MOCP	-	Maximum Overcurrent Protection
MOD	-	Modify
MTD	-	Mounted
MTG	-	Mounting
N:	-	Nothing

N, NEU	Neutral
N/A -	Not Applicable, Not Available
NAD -	North American Datum
NAVAID	Navigational Aid
NC -	Normally Closed
NEC -	NFPA 70 – National Electric Code
NECA -	National Electrical Contractors Association
NEMA -	National Electrical Manufacturers Association
NESC -	National Electric Safety Code
NF -	Non-Fused
NFPA -	National Fire Protection Association
NGVD -	National Geodetic Vertical Datum
NIC -	Not In Contract
NO -	Normally Open
NOTAM	Notice to Airmen (FAA Order 7930.2)
NRTL -	Nationally Recognized Testing Laboratory
NTS -	Not To Scale
NVG -	Night Vision Goggles with Class B Filter
NVIS -	Night Vision Imaging Systems
OC -	On Center
OCPD -	Overcurrent Protective Device
OD -	Outside Diameter
OFA -	Object Free Area
OSHA -	Occupational Safety and Health Administration
P -	Pole
PCC -	Portland Cement Concrete (Rigid Pavement)
PF -	Power Factor
PG -	Proposed Grade
PH -	Phase
PNL -	Panel or Panelboard
PPE -	Personal Protective Equipment
PSI -	Pounds Per Square Inch
PSSS -	Pavement Surface Sensor System
PT -	Potential Transformer
PT -	Point of Tangency
PVC -	Polyvinyl Chloride Conduit
PWR -	Power
QTY -	Quantity
REC -	Receptacle
REF -	Reference
REQ -	Required
REQ'D -	Required
RGS -	Rigid Galvanized Steel Conduit
RGL -	Runway Guard Lights
RLIM -	Runway Light Intensity Monitor
RMS -	Root Mean Square
ROFA -	Runway Object Free Area
RPR -	Resident Project Representative
RPU -	Remote Processing Unit, Remote Power Unit
RPZ -	Runway Protection Zone
RSA -	Runway Safety Area

RT	-	Right Offset
RVR	-	Runway Visual Range
RW,R/W		Runway
SC	-	Split Circuit
SCH	-	Schedule
SE	-	Service Entrance Rated
SGB	-	Service Grounding Bus Bar
SGRS	-	Switchgear-Style Regulator System
S/N	-	Solid Neutral
SPD	-	Surge-Protective Device
SS	-	Stainless Steel
ST	-	Shunt Trip
STA	-	Station
STD	-	Standard
STP	-	Shielded Twisted Pair
SW	-	Switch
TDZ	-	Touchdown Zone
THD	-	Total Harmonic Distortion
TL T/L	-	Taxilane
TOC	-	Top of Concrete
TOD	-	Top of Duct
TOFA	-	Taxiway Object Free Area
TP	-	Taper Point
TSA	-	Taxiway Safety Area
TVSS	-	Transient Voltage Surge Suppression Device
TW, T/W		Taxiway
TYP	-	Typical
UG	-	Underground
UL	-	Underwriters' Laboratories, Inc.
UON	-	Unless Otherwise Noted
UPS	-	Uninterruptible Power Supply
UTP	-	Unshielded Twisted Pair
V	-	Voltage, Volts
VA	-	Volt-Amperes
VAC	-	Voltage Alternating Current
VDC	-	Voltage Direct Current
VFD	-	Variable Frequency Drive
VSD	-	Variable Speed Drive
W	-	Wire, Watt
W/	-	With
WP	-	Weatherproof Equipment Protection
XFMR	-	Transformer

Refer to the following references for additional abbreviations not defined above.

- FAA (<https://www.FAA.gov/airports/resources/acronyms/>)
- FAA Advisory Circular AC 150/5340-30J Appendix C
- NFPA 70 National Electric Code (NEC) (<https://www.nfpa.org>)
- NECA 100 (<https://necanet.org>)
- Other applicable codes and specifications

DEFINITIONS

100-3.1 INDICATED. The term "as indicated" as used in these documents shall be understood to mean "as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents". Terms such as "shown", "noted", "scheduled", and "specified" shall be understood to have same meaning as "indicated".

100-3.2 PROVIDE The terms "Provide" and "Provided" as used in these documents shall be understood to mean "contractor shall provide complete in place" as well as "contractor shall furnish and install".

100-3.3 FURNISH. The term "Furnish" as used in these documents shall be understood to mean "contractor shall procure product/equipment from supplier or manufacturer and store as recommended by manufacturer until product/equipment is accepted by owner or other party designated to install product/equipment". Contractor shall store and protect product/equipment in environment (dry and/or conditioned) recommended by manufacturer. Product/Equipment shall be inspected by owner and installer prior to acceptance. If product is damaged prior to acceptance, contractor shall replace product/equipment. Provide at least fourteen (14) calendar days notice of product/equipment estimated time of availability for inspection and acceptance. Storage and shipping of product/equipment shall be incidental to cost of equipment.

100-3.4 INSTALL. The term "Install" as used in these documents shall be understood to mean "contractor shall install product/equipment furnished by owner or other party designated to furnish product/equipment". Contractor shall inspect product/equipment for damage or manufacturer defects prior to acceptance and submit notification of acceptance or damage/defects to owner and engineer. If product is found to be damaged after acceptance, contractor shall replace product/equipment. Unless damaged or defective, product/equipment shall be accepted within seven (7) calendar days of notice of availability. Contractor shall protect and store accepted product/equipment in environment (dry and/or conditioned) recommended by manufacturer until installed. Storage of accepted product/equipment shall be incidental to cost of equipment installation.

100-3.5 OWNER-FURNISHED EQUIPMENT, Contractor shall receive, inspect, unload, store, protect, assemble, install, and coordinate installation of all Owner-furnished equipment. Damage occurring after acceptance by the Contractor shall be repaired or replaced at the Contractor's expense.

100-3.6 DAY. The term "Day" or "Days" shall be understood to be calendar days, unless otherwise noted.

100-3.7 OWNER. The terms "owner" and "airport" as used in these documents are interchangeable and shall be understood to mean "owner's designated contracting officer and site representative".

100-3.8 ENGINEER. The terms "engineer" as used in these documents shall be understood to mean:

- "Engineer of Record" – Licensed engineer or engineering firm that produced the design documents.
- or
- 3rd Party Licensed engineer or engineering firm that has been identified by the owner as the "engineer" responsible for reviews, approvals, and other construction administration duties affecting or modifying the design defined by these construction documents.

SUMMARY OF WORK

100-4.1 QUALIFIED INSTALLER, SUPERVISION, AND ATTENDANCE. Submit the airfield electrical contractor qualifications of the installers to the engineer for written approval. The airfield electrical contractor shall have a minimum of three (3) years of experience and a minimum of two (2) past successful projects, [each with project cost 25% or greater of current project bid, installing or replacing airfield lighting systems (including runway lighting, taxiway lighting, airfield guidance signs, wind indicators, PAPI lighting, approach lighting, airfield lighting vault electrical systems, airfield lighting constant current regulators) of the same type and kind included in this project.

The approved qualified contractor installer shall be present at all times that work under this division is being installed or affected.

100-4.2 RECORD DOCUMENTS. Maintain contract documents, shop drawings and samples at the project site, in good order. Maintain a single clean master mark-up set of drawings, showing as-built conditions. All changes or clarifications to the installation made in the field shall be reflected on the master set within 48 hours of making any changes from the construction documents.

Upon request, On-Site contract documents, shop drawings, samples and master mark-up set shall be made available to the Engineer for examination.

Upon request, submit to the engineer dimensioned installation layout drawings for approval.

Prior to final acceptance, submit a licensed land surveyor's as-built survey of the installed PAPI system, including the final northing, easting, and elevation of each PAPI foundation, PAPI lens center elevation, PCA foundation location, and the horizontal location of all new underground electrical facilities. Submit the survey to the Engineer prior to FAA commissioning and flight check

Turn in the master markup set to the engineer at the end of construction.

100-4.3 ENGINEERING INSPECTIONS. Items noted by the Owner, Engineer or RPR during construction and before final acceptance, which do not comply with the contract, documents will be listed in accordance with the specifications. These items will be sent to the Contractor for action. The Contractor shall have these items corrected.

Items noted after acceptance during the warranty period shall be checked and corrected by the Contractor in a timely manner acceptable to the Owner.

100-4.4 EXISTING CONDITIONS. Investigate the construction site thoroughly and reroute all conduit and wiring in area of new construction in order to maintain continuity of existing circuitry. Existing conduit shown on plans show approximate locations only. The Contractor must verify and coordinate existing site utilities, conduits and piping. Hand excavation shall be performed as required by the utility owner, Contract Documents, and applicable safety requirements when working adjacent to existing underground utilities.

Check the construction site and existing conditions thoroughly before bidding and advise the Engineer of discrepancies or questions noted.

Special attention is called to the fact that work involved in this project is in connection with existing systems/facilities, which must remain in operation while work is being performed. Work must be done in accordance with the schedule specified in the contract documents. Schedule work for a minimum outage to the Owner. Request written permission and receive written approval from the Owner a minimum of 48 hours in advance of any shut-down of existing systems. Perform work required at other than standard working hours where outages cannot be approved during regular working hours. Protect existing buildings

and equipment during construction as required.

Special attention is called to the fact that there may be piping, fixtures or other items in the existing systems, which must be removed or relocated in order to perform the alteration work. All conduit, wiring, boxes, etc. that do not comply with these specifications shall be removed or corrected to comply with these specifications. All unused conduit not removed shall be identified and a pull line shall be installed. Bid shall include all removal and relocation required for completion of the alterations and the new construction.

Field measure and verify all existing dimensions, elevations, and conditions that may be required to locate, align, dimension, and detail the construction within specified tolerances. Field measurements shall be performed prior to the preparation of shop drawings and the manufacturing, fabrication, and installation of all items of construction. Deviations from the contract drawings shall be brought to the attention of the engineer prior to the preparation of shop drawings.

Report all conflicts within the contract documents or with existing conditions in the field to the engineer within 24 hours. Submit photographs and/or sketches to clarify conditions upon request.

If any difference is discovered between the existing conditions and the drawings or specifications, the Engineer shall be notified in writing immediately.

100-4.5 WORK SEQUENCE

Install Work to accommodate Airport's present occupancy and operations requirements during the construction period. Coordinate electrical schedule and operations with Owner, RPR, and other Contractors working on site and other requirements of the specifications. Coordinate all work affecting FAA-owned facilities with the Engineer, Owner, FAA Technical Operations, and FAA SSC, as applicable. Provide advance notice as required by the Contract Documents. Maintain all active airfield lighting systems operational at the end of each work day.

Shutdown of existing electrical facilities shall be kept to an absolute minimum and coordinated with the Engineer. Shutdown shall be made at hours convenient to the Airport. This includes evening and weekend hours.

The cost of any anticipated overtime work shall be included in the Contractor's base bid. Requests for additional compensation for this work after award of contract will be refused.

Coordinate all work with all other contractors and subcontractors.

100-4.6 SYSTEMS GUARANTEE. The work required under this specification shall include a one (1) year warranty unless required otherwise by these specifications. This warranty shall be by the Contractor to the Owner for any defective workmanship or material, which has been furnished under this contract for a period of one year (1) from the date of final acceptance of the system.

A warranty shall be provided for LED light fixtures extending for four (4) years from the date of final acceptance of the system.

If within the warranty period any work or equipment is found to be defective, contractor shall correct it within 14 calendar days at no cost to the owner.

Explain the provisions of the warranty to the Owner at the "Demonstration of Completed System."

100-4.7 SUBSTANTIAL COMPLETION. All specified work shall be complete prior to final inspection of the work, and all forms and other information requested, including maintenance manuals, shall be submitted to the Engineer for approval one (1) week before the request for substantial completion of the work.

The Contractor shall demonstrate the function of any equipment and system as requested. In the event that any equipment or system does not function correctly, the Contractor shall perform any tests and provide test equipment required to ascertain the cause.

100-4.8 FINAL ACCEPTANCE. All work specified shall be complete after the substantial completion observation, all repairs made, and all required information approved at which time the Owner shall formally accept the project and take possession of all work on a permanent basis.

100-4.9 CONTRACTOR'S RESPONSIBILITIES. Provide all work, tools, layout, transportation, equipment, services, labor, supervision, and materials for the installation of complete and functional electrical systems as described or implied by the contract documents. Items not shown but necessary for completion of the work shall be included.

Unload, store, protect and re-handle the materials required for this contract until such time that material is in place. Provide protection of materials required of this contract after installation.

Provide all required transportation, erection, maintenance, dismantling and removal of temporary facilities and equipment required by this contract.

Provide all transportation, unloading, distribution, hoisting, rigging, material handling and scaffolding required to install the work of this contract.

Provide all engineering and layout required to perform the work.

Provide all required temporary electrical power, water, and sanitary sewer services for the Contractor's field office, Engineer's field office and on-site testing laboratory. Pay all utility company charges. Provide temporary power required for the Contractor's work.

Prior to start of his work the Contractor is to inspect work performed by others on which this work is to be placed on or adjacent to, and report in writing to the RPR, any condition found to be unacceptable. Failure to make said report shall constitute acceptance of the conditions found and any claims made thereafter due to the unacceptable conditions will not be considered by the RPR.

Provide all required coordination and supervision where work connects to or is affected by work of others and comply with all requirements affecting this work. Work required under other sections, specifications or drawings to be performed by this section shall be coordinated with the respective contractor, and such work performed at no additional cost to the Owner including but not limited to electrical work in support of the mechanical division of the specifications and drawings.

It is the responsibility of the Contractor to coordinate the exact required location of any electrical or electronic equipment, system, or cabinets to be installed in or relocated inside an existing electrical or electronic equipment space. No existing equipment may be relocated in any existing electrical or electronic equipment room without prior coordination and with written approval of the Owner.

Provide all tests as required, per the drawings and specifications and submit all test reports to the RPR to be forwarded to the Engineer.

Provide all excavation, backfill, compaction, shoring and dewatering required for performance of the work.

Provide sleeves for all conduit required as specified.

Protect all work of this contract from damage and intrusion of dirt and foreign objects. Close off open ends of conduit and sleeves on work, which is to be completed at a later date. Remove closure material prior to continuance of work.

Prior to Final Inspection, submit to the Engineer, all Record Drawings and Operation and Maintenance Manuals as specified. Instruct Owner's maintenance personnel in the operation and maintenance of the systems as required by the Specifications.

The above is not all inclusive of the work described by the drawings and Specifications, which form the basis for this contract, but is presented for the Contractor's convenience.

Coordinate installation sequencing with FAA commissioning requirements and provide all labor, equipment, and support necessary to facilitate FAA inspection, commissioning, and flight check activities.

100-4.10 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS. Should anything necessary for the clear understanding of the electrical work be omitted from the contract documents, or should the requirements appear to be in conflict, the Contractor shall secure written instructions from the Engineer before proceeding with the work affected thereby; otherwise the Contractor will be deemed to be proceeding at his own risk and expense. It is understood and agreed that the work shall be performed according to the true intent of the contract documents.

SAFETY AND PROTECTION

100-5.1 RESPONSIBILITY. The Contractor shall be solely and completely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

- a. All employees on the work and other persons (including but not limited to the general public) who may be affected thereby,
- b. All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and
- c. Other property at the site, adjacent thereto, or utilized by the Contractor including but not limited to trees, shrubs, lawns, walks, pavements, structures, underground facilities, and other utilities not designated for removal, relocation or replacement in the course of construction regardless of whether or not such other property is indicated in the Contract Documents.
- d. Existing underground utilities and systems both shown on the plans and those not shown. The Contractor shall have all utilities and systems field located by the FAA or appropriate authorities having jurisdiction and shall take whatever measures necessary to protect the utilities and systems from damage.

Comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss.

All hoisting machinery shall be inspected by a competent person or by a government or private agency recognized by the U.S. Department of Labor. A copy of the written inspection report shall be submitted to the Engineer prior to the start of work requiring the use of this equipment.

The installation and/or removal of lighting equipment may be critical to airport operations; therefore, the Contractor shall follow work schedules established in the plans and specifications or as directed by the Engineer.

Provide temporary wiring as required to reconnect existing circuits to provide guidance for aircraft to pass through the construction areas on those taxiways/runways, which must remain open. Check all temporary circuits before dark each day to assure that they are operational. In the event of failure, immediately take steps to restore operation.

Provide the bracing, sheeting, shoring, rails, guards, and covers necessary to prevent damage or injury.

Do not leave energized electrical items unnecessarily exposed or unprotected. Protect personnel from exposure to contact with electricity.

All sheeting, shoring, dewatering and cleaning necessary to keep trenches and their grades in proper condition for the work to be carried on, including the removal of water by mechanical means, shall be the Contractor's responsibility.

Clean up scrap materials and waste from construction and demolition activities daily or more frequently as needed.

BASIC MATERIAL & METHODS

100-6.1 REQUIREMENTS. The work shall include the furnishing of the systems, equipment and material specified in these specifications and as called for on the drawings, to include: supervision, operations, methods and labor for the fabrication, installation, start-up and tests for the complete electrical installation. Provide the necessary intertrade/Contractor coordination for the installation to be in a neat and workman like manner.

Drawings for the work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangement and locations of the work. The drawings shall not be scaled for exact sizes or locations. Because of the scale of the drawings, certain basic items such as: conduit fittings, access panels, sleeves, pull and junction boxes may not be shown. Where such items are required by Code or by other sections or where they are required for proper installation of the work, such items shall be included. Coordinate final equipment locations with governing architectural and structural drawings. Layout equipment before installation so that all trades may install equipment in the space available.

Equipment specifications may not deal with minute items such as components, parts, controls and devices, which may be required to produce the equipment performance specified, or as required to meet the equipment warranties. Where such items are required, they shall be included by the Contractor or the supplier of the equipment, whether or not specifically called for.

The drawings and specifications describe specific sizes of switches, breakers, fuses, conduits, conductors and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters), lights, motors for fans, compressors, pumps, etc.) Wherever the Contractor provides power consuming equipment, which differs from drawings and specifications, the wiring and associated circuit components for such equipment shall be changed to proper sizes to match at no additional expense to the Owner.

100-6.2 MATERIALS. Materials included in this project shall be new, free of defects, and in accordance with project specifications and installed per manufacturer recommendations, uon. All materials shall be labeled and listed for use intended by a NRTL (e.g. UL Underwriters' Laboratories, Inc., ETL Intertek, CSA, FM approvals, etc) when a standard for such material and use exist. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards. All listed, labeled or approved material shall be used only for the intended purpose.

Products and materials shall comply with the latest edition of referenced standards and publications (e.g. FAA, ICAO, NEMA, ANSI, ASTM, IEEE, AEIC, ICEA, etc). The latest edition shall be the most recent publication date in effect as of the date of the advertisement for bids, except when a specific publication date is specified.

Materials utilized shall be suitable for the environment encountered. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture. Use conductors with protective coatings where ambient conditions may cause accelerated deterioration or corrosion of conductors (e.g. locations exposed deicing materials, salt, chemicals, cleaners, etc).

Galvanized materials shall be hot-dip galvanized after fabrication, conforming to ASTM A123 and/or A153, uon.

100-6.3 ACTIVE SERVICES. Existing active services i.e., water, gas, sewer, electric, communications, etc. when encountered, shall be protected against damage. Do not prevent or disturb operation of active services, which are to remain. If active services are encountered which require relocation, the Contractor shall make a written request to the Owner for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality or Authority having jurisdiction.

100-6.4 SERVICE INTERRUPTIONS

Electrical service is defined as any electrical, communication, data, fire alarm and any other electrical transmission system. Other services include but are not limited to water, sanitary, gas, HVAC and storm water systems.

Coordinate all required service and facility shutdowns through the RPR.

Notify the Owner and the RPR of the intent to perform any Work requiring service interruptions and shall proceed with such work only after receiving a time schedule approved by the Owner and RPR. The Owner and the RPR shall have the right to cancel or delay the time of any service interruption. Provide required personnel and equipment to assist in the proper coordination of service interruptions. The Contractor shall not leave the job site until resumption of normal service is satisfactory to the Owner and RPR.

Contractor shall perform all work involving service interruptions at times designated by the RPR or at night and/or Saturday or Sunday. No allowances will be made for overtime labor costs.

Where Contractor interrupts any electrical or other service due to damaging equipment or cable through their negligence, they shall be required to repair or replace the equipment or cable immediately, working continuously to restore service until satisfactory to the RPR. Repair, replacement or both shall be at the discretion of the RPR and at the expense of the Contractor.

The Airport shall be occupied and in use during the construction period. Contractor shall not disturb continuity of service to any area without the written approval and agreement as to time and duration of such interruption. Contractor shall perform any of this work at any time without extra cost to owner.

Fully examine all areas of demolition in this contract and identify all services related to its trades. Provide protection of such service to prevent disruption of service. Reroute services to remain as required to approved locations without extra cost to the Owner.

100-6.5 GLIDESLOPE SHELTER PENETRATIONS. All penetrations into existing FAA facilities shall be core drilled unless otherwise approved by the Engineer. Seal all conduit penetrations weather-tight and restore the building envelope to its original condition, including all firestopping, waterproofing and weatherproofing.

100-6.6 PERMIT LICENSES AND FEES. Provide and pay for all permits, licenses, services, fees and inspections required for the performance of the work, including any applicable sales, consumer, use or other taxes required to be paid in accordance with the laws of the place of the project.

Permits shall be obtained in a timely fashion to ensure no negative impact on the construction schedule. Notify the code enforcing authorities and schedule all required inspections with the all authorities having jurisdiction (e.g. FAA, state, county, city, local, etc).

Associated costs shall be incidental to the project and shall be included in the Contractor's Bid Price.

Deliver to the Owner and RPR, prior to the start of construction, a copy of all permits and licenses required for the work. At the completion of the work, secure and deliver to the Owner and Engineer all certificates of compliance of local authorities.

100-6.7 UTILITY FEES, CHARGES, COSTS. Contact each applicable Utility Company to determine if any requirements, fees, charges, and costs that will be required for temporary power, installations, hook-ups, etc.

Associated costs shall be incidental to the project and shall be included in the Contractor's Bid Price.

100-6.8 TESTS. Test and place systems in proper working order prior to demonstrating systems to the Owner. Refer to each section for applicable requirements and applicable standards.

After work is completed, a load balance test shall be made, as required, to demonstrate that with full lighting and mechanical load the balance between phases is within 5%. Unbalance beyond this limit shall be corrected.

Perform such tests as required by any Authorities Having Jurisdiction over the site.

Testing methods shall be acceptable to the RPR and shall be submitted to the Engineer for review, a

minimum of thirty (30) days prior to the scheduled test.

Supply all labor, materials, instruments and miscellaneous equipment for any examination of work or tests as required. All test results shall be recorded and submitted to the Engineer. Upon completion of installation, the Contractor shall coordinate and perform all acceptance testing required by the Contract Documents and applicable FAA standards. The Contractor shall install and preliminarily align the PAPI units in accordance with the Contract Documents and FAA Order 6850.2C prior to FAA commissioning and flight inspection. Final aiming adjustments shall be made as directed by the FAA. The PAPI system shall be fully operational and ready for FAA commissioning and flight check prior to final acceptance. Contractor shall submit certified test reports prior to requesting Final Acceptance. All testing required by the Contract Documents shall be witnessed by the Engineer and FAA Representative.

100-6.9 CONCRETE WORK. Concrete bases and pads for all equipment furnished by the Contractor shall be the responsibility of the Contractor unless noted otherwise.

The Contractor shall furnish all equipment anchor bolts and shall be responsible for their proper installation and accurate location.

100-6.10 EXCAVATING, TRENCHING AND BACKFILLING. The Contractor shall do excavating necessary for light bases, sign foundations, underground wiring, conduit and ductbanks and shall backfill trenches and excavations after work has been inspected. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way, except where lines must cross under a wall footing. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the conduit. Excavations shall be kept free from water. No greater length of trench shall be left open in advance of conduit laying than that, which is authorized or directed by the Engineer.

Roots shall be removed to a level of eighteen (18") below furnished grades and deeper as required for duct runs, manholes and light pole bases. No roots shall be allowed to remain under the work.

Backfill about the structures shall be placed, where practical, as the work of construction progresses. Backfilling on or against concrete work shall be done only when directed. Backfilling of duct lines shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit and shall be carried to a crown approximately six inches (6") above the existing grades. In backfilling around duct lines, selected material shall be compacted firmly around the duct. Fill and backfill shall be clean and free from vegetable matter and refuse.

All trenches and other excavation left open by necessity shall be barricaded and guarded as required by OSHA or applicable codes and regulations.

100-6.11 WELDING. All welding and weld procedures shall be in accordance with AWS D1.1 (Latest Edition).

Qualifications of welders and welding operators shall be in accordance with AWS D1.1, (Latest Edition). The welder qualification test shall be performed on a 1" A-36 Test Coupon in the 3G and 4G positions. The welder qualification shall be current within 12 months of the work being performed. Weld inspections shall be per the criteria set forth in AWS D1.1 for visual weld inspection.

DESIGNATION OF MATERIALS

100-7.1 CRITERION DESIGNATION OF MATERIALS AND EQUIPMENT. Where a criterion

specification is designated for any material or equipment to be installed by the name or catalog number of one specific manufacturer, such designation is intended only for the purpose of establishing the style, quality, performance characteristics, etc., and is not intended to limit acceptability of competitive products. Products of other manufacturers which are approved by the Engineer as similar and equal will be equally acceptable unless specifically otherwise stated.

Where equipment or materials are specified by the use of the name and catalog number of more than one manufacturer, that equipment or material shall be one of those specified. No alternative will be acceptable.

Where no brand name is specified, the source and quality shall be subject to the Engineer's review and acceptance.

When a product is specified to be in accordance with a trade association or government standard, at the request of the Engineer, the Contractor shall furnish a certificate that the product complies with the referenced standard. Upon request of the Engineer, the Contractor shall submit supporting test data to substantiate compliance.

The Engineer shall be the sole judge of whether the proposed "or equal" is suitable for use in the work.

Each Bidder represents their bid is based upon the materials and equipment described in these specifications. Substitutions will not be considered unless a written request has been submitted to the Engineer or FAA representative.

If the Contractor desires to use a method or type of equipment other than specified in the contract documents, a written request therefore shall be made to the Engineer. If approval is given, the Contractor will not be excused from producing work in conformity with contract requirements. If a trial use establishes that work does not meet the contract requirements, the Contractor shall take such action as the Engineer determines necessary to correct any deficiency in the work. No change in contract time will be made as a result of changes made under this Subparagraph. By making a request for substitution, the Contractor:

- a. Represents that it has personally investigated the proposed substitution and determined the proposed substitution equal or superior in all respects to the specified method or equipment;
- b. Represents that it will provide a warranty for the substitution identical in all respects to the warranty for the specified method or equipment;
- c. Represents that it will coordinate the installation of the accepted substitute, making changes as may be required for the work to be complete in all respects at no additional cost to the Owner.

PROTECTION OF MATERIALS, EQUIPMENT AND WORK

100-8.1 REQUIREMENT. Deliver equipment and materials to the job site in their original, unopened, labeled containers. Materials shall be stored so as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall be subject to reinspection prior to their use in the work. Coordinate the storage of all materials with the Owner and the RPR. Materials stored prior to installation, shall be stored in a bonded and secured facility. Store finished materials and equipment to prevent corrosion, staining and discoloring. Store unfinished ferrous materials to prevent corrosion (rusting).

Owner-furnished materials, if any, shall be made available to the Contractor at the location specified herein.

All costs of handling, transportation from the specified location to the site of the work, storage and installation of Owner-furnished materials shall be included in the Contractor's Bid. All risk of loss or damage to Owner-furnished materials shall pass to the Contractor after delivery of said material to the site of the work. The Owner shall be entitled to deduct from any monies due or to become due to the Contractor any cost incurred by the Owner resulting directly or indirectly from a loss caused in whole or in part by the Contractor's handling, storage or use of Owner-furnished materials. The Contractor shall protect all Owner-furnished equipment from damage during unloading, storage, handling, and installation. Any damage occurring after acceptance by the Contractor shall be repaired or replaced at no additional cost to the Owner.

Protect electrical raceway, cables of any sort, lighting fixtures and associated support systems against damage from movement of equipment and material, welding, flame cutting, and other construction damage. Raceways and supporting structures for raceway and lighting fixtures shall not be used as access scaffolding at any time. Whenever welding or flame cutting operations occur above or near raceways, cables or lighting fixtures not shielded from such operations by concrete floor or other protective covers, the Contractor shall protect the raceways, cables, and lighting fixtures from damage by means of fireproof boards or blankets. Damaged materials shall be repaired or replaced, by and at the Contractor's expense, subject to the RPR and Owner's direction and acceptance.

Surfaces of most equipment, such as panels, switchgear, transformers, constant current regulators and circuit breakers, are finished at the factory. Great care shall be exercised to prevent damage to this original finish during installation of the equipment and during construction work.

If the factory finish is damaged during the course of construction, the entire surface of the damaged component shall be refinished or replaced by and at the expense of the Contractor.

The refinished surface shall be equivalent in every respect to the original surface, including color, texture and smoothness. Refinishing paint, if furnished with the equipment, may be used; otherwise, the paint shall be obtained from the equipment manufacturer.

Cut edges of galvanized materials and marred or scratched galvanized surfaces shall be repaired using LPS-1G cold galvanizing compound or approved equivalent.

All threaded conduit joints shall use T&B Kopr-shield, Aluma-Shield, or approved equivalent for galvanized and aluminum conduits respectively, as joint compound.

LIQUIDATED DAMAGES

100-9.1 LIQUIDATED DAMAGES. It is recognized that the Owner will incur costs associated with employees' salaries, engineering fees, temporary equipment, and otherwise in connection with the damage, inspection, and repair of any such damage, caused by the Contractor; and consequently that the Owner may incur loss of income by reason of the diversion of aircraft traffic from the airport resulting from interruption of the use of airport facilities; and that such expenses and loss of income are not measurable now and may not be reasonably ascertainable at the time of any incident caused by the Contractor. The Owner and the Contractor hereby agree to the assessment of liquidated damages in lieu of such expenses of other damages incurred by the Owner. In addition to the obligation of the Contractor to immediately repair any cables or facilities damaged by the Contractor, the sum of \$1,000.00 per hour shall be deducted daily from the money due the Contractor, or if no money is due the Contractor, the Owner shall have the right to recover said sum or sums from the Contractor, from the surety, or from both. The amount of these deductions are to cover liquidated damages to the Owner incurred by additional and other expenses and damages arising from the incident or incidents caused by the Contractor, and such deductions are not considered penalties.

METHOD OF MEASUREMENT

100-10.1 The items described in this section are incidental to other sections and shall not be measured for payment.

BASIS OF PAYMENT

100-11.1 No direct payment shall be made for the work described in this specification. The work described in this specification is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF ITEM L-100

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.

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 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. 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.

Ground rods shall be copper-clad steel or sectional 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.

FAA PAPI guard wire shall be #1/0 stranded bare copper wire. Ground wire in duct for FAA PAPI shall be #10 XHHW-2 or THWN-2 green copper ground. All FAA PAPI wire shall conform to the requirements of Department of Transportation, Federal Aviation Administration Standards.

PAPI control, power and grounding conductors shall be installed as shown on the Contract Drawings.

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. A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by 3M™ Company, "Scotchcast" Kit No. 82-B, or an approved equivalent, used for potting the splice is acceptable.

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 or heat shrink tubing with integral sealant 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 (38 mm) wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch (50 mm) 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 (1 m) 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 (30 cm) 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 (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

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 that 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. Unless otherwise specified, the Contractor shall not use a cable plow for installing the cable. Cable shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end. Slack cable sufficient to provide strain relief shall be placed in the trench in a series of S curves. Sharp bends or kinks in the cable shall not be permitted.

Where cables must cross over each other, a minimum of 3 inches (75 mm) vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.

a. Trenching. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed. Graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches (0.5 m) below finished grade per NEC Table 300.5, except as follows:

- When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches (91 cm) unless otherwise specified.
- Minimum cable depth when crossing under a railroad track, shall be 42 inches (1 m) unless otherwise specified.

The Contractor shall excavate all cable trenches to a width not less than 6 inches (150 mm). Unless otherwise specified on the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill material may alternatively be used. Duct bank or conduit markers temporarily removed for trench excavations shall be replaced as required.

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:

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

(2) 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 or replacement.

b. Backfilling. After the cable has been installed, the trench shall be backfilled. The first layer of backfill in the trench shall encompass all cables ; be 3 inches (75 mm) deep, loose measurement; and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. This layer shall not be compacted. The second layer shall be 5 inches (125 mm) deep, loose measurement, and shall contain no particles that would be retained on a one inch (25.0 mm) sieve. The remaining third and subsequent layers of backfill shall not exceed 8 inches (20 cm) of loose measurement and be excavated or imported material and shall not contain stone or aggregate larger than 4 inches (100 mm) maximum diameter.

The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent material. If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.) the backfill compaction shall be backfill with controlled low strength material (CLSM) in accordance with P-153.

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 when turf is to be established over the trench, the backfilling shall be stopped at an appropriate depth consistent with the type of turfing operation to be accommodated. A proper allowance for settlement shall also be provided. Any excess excavated material shall be removed and disposed of per the plans and specifications.

Underground electrical warning (caution) tape shall be installed in the trench above all direct-buried cable. Contractor shall submit a sample of the proposed warning tape for acceptance by the RPR. If not shown on the plans, the warning tape shall be located 6 inches (150 mm) above the direct-buried cable or the counterpoise wire if present. A 3-6 inch (75 - 150 mm) wide polyethylene film detectable tape, with a metalized foil core, shall be installed above all direct buried cable or counterpoise. The tape shall be of

the color and have a continuous legend as indicated on the plans. The tape shall be installed 8 inches (200 mm) minimum below finished grade.

c. Restoration. Following restoration of all trenching near airport movement surfaces, the Contractor shall visually inspect the area for foreign object debris (FOD) and remove any that is found. Where soil and sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by work shall be restored to its original condition. The restoration shall include the sodding as shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. When trenching is through paved areas, restoration shall be equal to existing conditions. If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.) the backfill compaction shall be backfill with controlled low strength material (CLSM) in accordance with P-153. Restoration shall be considered incidental to the pay item of which it is a component part.

108-3.4 Cable markers for direct-buried cable. The location of direct buried circuits shall be marked by a concrete slab marker, 2 feet (60 cm) square and 4-6 inch (10 - 15 cm) thick, extending approximately one inch (25 mm) above the surface. Each cable run from a line of lights and signs to the equipment vault shall be marked at approximately every 200 feet (61 m) along the cable run, with an additional marker at each change of direction of cable run. All other direct-buried cable shall be marked in the same manner. Cable markers shall be installed directly above the cable. The Contractor shall impress the word "CABLE" and directional arrows on each cable marking slab. The letters shall be approximately 4 inches (100 mm) high and 3 inches (75 mm) wide, with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep. Stencils shall be used for cable marker lettering; no hand lettering shall be permitted.

At the location of each underground cable connection/splice, except at lighting units, or isolation transformers, a concrete marker slab shall be installed to mark the location of the connection/splice. The Contractor shall impress the word "SPLICE" on each slab. The Contractor also shall impress additional circuit identification symbols on each slab as directed by the RPR. All cable markers and splice markers shall be painted international orange. Paint shall be specifically manufactured for uncured exterior concrete. After placement, all cable or splice markers shall be given one coat of high-visibility aviation orange paint as approved by the RPR. Furnishing and installation of cable markers is incidental to the respective cable pay item.

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. These shall be made by using crimp connectors for jointing conductors. Molds shall be assembled, and the compound shall be mixed and poured per the manufacturer's instructions and to the satisfaction of the RPR.

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 one of the following methods: (1) wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches (38 mm) on each side of the joint (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches (38 mm) on each side of the joint or (3) On connector kits equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

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 one of the following methods: (1) Wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches (38 mm) on each side of the joint. (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches (38 mm) on each side of the joint. or (3) On connector kits so equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

d. Taped or heat-shrink splices. A taped splice shall be made in the following manner:

Bring the cables to their final position and cut so that the conductors will butt. Remove insulation and jacket allowing for bare conductor of proper length to fit compression sleeve connector with 1/4 inch (6 mm) of bare conductor on each side of the connector. Prior to splicing, the two ends of the cable insulation shall be penciled using a tool designed specifically for this purpose and for cable size and type. Do not use emery paper on splicing operation since it contains metallic particles. The copper conductors shall be thoroughly cleaned. Join the conductors by inserting them equidistant into the compression connection sleeve. Crimp conductors firmly in place with crimping tool that requires a complete crimp before tool can be removed. Test the crimped connection by pulling on the cable. Scrape the insulation to assure that the entire surface over which the tape will be applied (plus 3 inches (75 mm) on each end) is clean. After scraping, wipe the entire area with a clean lint-free cloth. Do not use solvents.

Apply high-voltage rubber tape one-half lapped over bare conductor. This tape should be tensioned as recommended by the manufacturer. Voids in the connector area may be eliminated by highly elongating the tape, stretching it just short of its breaking point. The manufacturer's recommendation for stretching tape during splicing shall be followed. Always attempt to exactly half-lap to produce a uniform buildup. Continue buildup to 1-1/2 times cable diameter over the body of the splice with ends tapered a distance of approximately one inch (25 mm) over the original jacket. Cover rubber tape with two layers of vinyl pressure-sensitive tape one-half lapped. Do not use glyptol or lacquer over vinyl tape as they react as solvents to the tape. No further cable covering or splice boxes are required.

Heat shrinkable tubing shall be installed following manufacturer's instructions. Direct flame heating shall not be permitted unless recommended by the manufacturer. Cable surfaces within the limits of the heat-shrink application shall be clean and free of contaminants prior to application.

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-019G, Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment, Part 4.1.1.7.

b. Isolation –not used.

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

Grounding electrodes may be rods, ground dissipation plates, radials, or other electrodes listed in the NFPA 70 (NEC) or NFPA 780.

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 (150 m) 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. Provide grounding and bonding in accordance with NFPA 70, National Electrical Code.

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 **100** 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 PAPI power, control, and grounding conductors installed in conduit between the Runway 18R Glide Slope Shelter and the PAPI Power and Control Assembly (PCA) rack shall be measured by the linear foot of the complete conductor installation, in place and accepted, measured along the conduit route between the limits shown on the Contract Drawings. Measurement shall include all conductors comprising the circuit, required cable slack, identification, connectors, terminations, grounding conductors, testing, and incidentals necessary for a complete installation.

Conductors installed between the PCA rack and the PAPI units shall not be measured under this item and shall be included in the PAPI PCA Rack and PAPI Support System pay item under Item L-125.

108-4.2 No separate payment will be made for ground rods.

108-4.3 No separate payment shall be made for the removal and reinstallation of existing cable in existing duct bank or conduit or the removal of existing cable where the drawings indicate the furnishing and installation of cable. These items are considered incidental to this work and shall be included in the Contractor's unit price.

BASIS OF PAYMENT

108-5.1 Payment for PAPI power, control, and grounding conductors installed in conduit between the Runway 18R Glide Slope Shelter and the PCA rack shall be made at the Contract unit price per linear foot. This price shall constitute full compensation for furnishing and installing all required power conductors, control conductors, equipment grounding conductors, cable identification, connectors, terminations, required slack, testing, and all labor, materials, equipment, tools, and incidentals required for a complete installation.

Conductors and associated wiring between the PCA rack and the PAPI units shall be included in the PAPI PCA Rack and PAPI Support System pay item and shall not be separately measured or paid under Item L-108.

Payment will be made under:

Item L-108-5.1	Furnish and Install PAPI Power, Control, and Ground Conductors from Glide Slope Shelter to PCA Rack – per Linear Foot
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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
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Federal Aviation Administration Standard

FAA STD-019G	Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment
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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 electronically submitted in pdf format, tabbed by specification section. 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 (75-150 mm) wide. Detectable tape is incidental to the respective bid item.

110-2.10 Tracer Wire. Provide continuous insulated copper tracer wire with underground nonmetallic conduit systems where indicated on the Contract Drawings. Tracer wire shall be suitable for direct burial and utility locating service. Provide waterproof/direct-burial-rated splices and connections. Route tracer wire continuously with the conduit system and provide accessible termination points at handholes and equipment locations.

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 (50 mm) 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 (75 mm) per 100 feet (30 m). 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 (0.5 m) below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches (0.5 m) 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 (6 mm) 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 (90 kg) 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 (1.5 m).

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 (75 mm) 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 (6.3 mm) 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.

Install tracer wire continuously along underground nonmetallic conduit routes. Provide sufficient slack at handholes and equipment locations for testing and future connection to locating equipment. Splices, where unavoidable, shall be made with listed waterproof direct-burial connectors. Test tracer wire for continuity after installation and prior to acceptance.

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 (60 cm).

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 (0.5 m) 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 (1 m) beyond the edges of the pavement or 3 feet (1 m) 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 (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inches (75 mm) 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 (75 mm) 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 (150 mm) 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 (1.5-m) 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 (1.5-m) 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 (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) 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 (150 mm) nor more than 12 inches (300 mm) 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 (100 mm) 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 (6.3 mm) 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 (0.5 m) 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 (60 cm) 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 (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) 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 (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) 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 (150 mm) 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 (1.5-m) 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. The location of each end and of each change of direction of conduits and duct banks shall be marked by a concrete slab marker 2 feet (60 cm) square and 4 - 6 inches (100 - 150 mm) thick extending approximately one inch (25 mm) above the surface. The markers shall also be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at approximately every 200 feet (61 m) along the cable or duct run, with an additional marker at each change of direction of cable or duct run.

The Contractor shall impress the word "DUCT" or "CONDUIT" on each marker slab. Impression of letters shall be done in a manner, approved by the RPR, for a neat, professional appearance. All letters and words must be neatly stenciled. After placement, all markers shall be given one coat of high-visibility orange paint, as approved by the RPR. The Contractor shall also impress on the slab the number and size of conduits beneath the marker along with all other necessary information as determined by the RPR. The letters shall be 4 inches (100 mm) high and 3 inches (75 mm) wide with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

110-3.5 Backfilling for conduits. For conduits, 8 inches (200 mm) 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 (100 mm) 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 backfill shall be select material not larger than 4 inches (100 mm) 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 (76 m) 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. Restoration necessary to return areas disturbed solely by L-110 construction to the condition required by the Contract Documents shall be incidental to the respective L-110 pay item. **Topsoil and sodding specifically identified on the Contract Drawings for separate measurement and payment shall not be included under Item L-110 and shall be paid under the applicable Topsoil and Sodding bid item. No duplicate payment will be made for restoration.**

110-3.8 Building Penetrations Where conduits enter existing buildings or FAA facilities, the Contractor shall core drill all wall penetrations unless otherwise shown on the plans or approved by the Engineer. Underground PVC conduit shall transition to rigid galvanized steel conduit (RGS) a minimum of 24 inches below finished grade unless otherwise shown on the plans. All conduit penetrations shall be sealed weather-tight and watertight using materials compatible with the wall construction and conduit system. Following conduit installation, restore all wall finishes, waterproofing, firestopping, and weatherproofing to their original condition. Coordinate all building penetrations with the Owner and FAA prior to construction.

METHOD OF MEASUREMENT

110-4.1 Underground conduit systems shall be measured by the linear foot of complete conduit system installed in place, completed, and accepted. Measurement shall be made along the centerline of the conduit route. A 2-way conduit system consisting of two conduits installed along a common route shall be measured as one linear foot of 2-way conduit system and not as two individual conduit lengths.

Separate measurement shall be made for:

- a. 2-Way, 2-Inch Schedule 80 PVC Conduit – Direct Earth Buried
- b. 2-Way, 2-Inch Schedule 80 PVC Conduit – Concrete Encased.

Measurement shall include conduit, fittings, bends, transitions, spacers, warning tape, tracer wire where applicable, pull rope, plugs, mandrelling, cleaning, trenching, excavation, bedding, backfill, compaction, testing, restoration, and other incidentals specified herein.

Direct-earth-buried conduit shall be measured from the Glide Slope Shelter toward the PCA rack, excluding the concrete-encased portion beneath the Glide Slope access drive. The concrete-encased portion beneath the Glide Slope access drive shall be measured separately.

BASIS OF PAYMENT

110-5.1 Payment shall be made at the Contract unit price per linear foot for the respective type of 2-way conduit system completed in place and accepted. Payment shall constitute full compensation for furnishing and installing both conduits comprising the 2-way system, fittings, bends, couplings, transition fittings, rigid galvanized steel conduit transitions, spacers, pull rope, conduit plugs, warning tape, tracer wire, mandrelling, cleaning, drainage provisions, trenching, excavation, bedding, backfill, compaction, testing, restoration, and all labor, materials, equipment, tools, and incidentals necessary to complete the work.

For the concrete-encased conduit item, payment shall additionally include sawcutting and pavement removal where required, conduit supports, concrete encasement, reinforcing/supports where indicated, and pavement/access-drive restoration.

Conductors installed within the conduit shall be measured and paid separately under Item L-108.

Payment will be made under:

Item L-110-5.1	2-Way, 2-Inch Schedule 80 PVC Conduit, Direct Earth Buried – per Linear Foot
Item L-110-5.2	2-Way, 2-Inch Schedule 80 PVC Conduit, Concrete Encased beneath Glide Slope Access Drive – 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
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National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)
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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

Item L-115 Electrical Manholes and Junction Structures

DESCRIPTION

115-1.1 This item shall consist of electrical manholes and junction structures (hand holes, pull boxes, junction cans, etc.) installed per this specification, at the indicated locations and conforming to the lines, grades and dimensions shown on the plans or as required by the RPR. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the RPR including removal of existing manholes and junction structures as shown on the plans.

EQUIPMENT AND MATERIALS

115-2.1 General.

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

b. 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.

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 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.

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 electronically submitted in pdf format, tabbed by specification section. 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 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.

115-2.2 Concrete structures. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures. Cast-in-place concrete structures shall be as shown on the plans.

115-2.3 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another engineer approved third party certification program. Provide precast concrete structures where shown on the plans.

Precast concrete structures shall be an approved standard design of the manufacturer. Precast units shall have mortar or bitumastic sealer placed between all joints to make them watertight. The structure shall be

designed to withstand 450,000 lbs. aircraft loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

Threaded inserts and pulling eyes shall be cast in as shown on the plans.

If the Contractor chooses to propose a different structural design, signed and sealed shop drawings, design calculations, and other information requested by the RPR shall be submitted by the Contractor to allow for a full evaluation by the RPR. The RPR shall review per the process defined in the General Provisions.

115-2.4 Junction boxes. Junction boxes shall be L-867 Class 1 (non-load bearing) or L-868 Class 1 (load bearing) airport light bases that are encased in concrete. The light bases shall have a L-894 blank cover, gasket, and stainless steel hardware. All bolts, studs, nuts, lock washers, and other similar fasteners used for the light fixture assemblies must be fabricated from 316L (equivalent to EN 1.4404), 18-8, 410, or 416 stainless steel. If 18-8, 410, or 416 stainless steel is utilized it shall be passivated and be free from any discoloration. Covers shall be 3/8-inch (9-mm) thickness for L-867 and 3/4-inch (19-mm) thickness for L-868. All junction boxes shall be provided with both internal and external ground lugs.

115-2.5 Mortar. The mortar shall be composed of one part of cement and two parts of mortar sand, by volume. The cement shall be per the requirements in ASTM C150, Type I. The sand shall be per the requirements in ASTM C144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C206. Water shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

115-2.6 Concrete. All concrete used in structures shall conform to the requirements of Item P-610, Concrete for Miscellaneous Structures.

115-2.7 Frames and covers. The frames shall conform to one of the following requirements:

- a. ASTM A48 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 Ductile iron castings
- f. ASTM A897 Austempered ductile iron castings

Furnish and Install spring-assisted composite lids where shown on the plans.

All castings specified shall withstand a maximum tire pressure of **217** psi and maximum load of **200,000** lbs.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

Each cover shall have the word "ELECTRIC" or other approved designation cast on it. Each frame and cover shall be as shown on the plans or approved equivalent. No cable notches are required.

Each manhole shall be provided with a "DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" safety warning sign as detailed in the Contract Documents and in accordance with OSHA 1910.146 (c)(2).

115-2.8 Ladders. Ladders, if specified, shall be galvanized steel or as shown on the plans.

115-2.9 Reinforcing steel. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A615, Grade 60.

115-2.10 Bedding/special backfill. Bedding or special backfill shall be as shown on the plans.

115-2.11 Flowable backfill. Flowable material used to backfill shall conform to the requirements of Item P-153, Controlled Low Strength Material.

115-2.12 Cable trays. Cable trays shall be of plastic or aluminum as shown. Cable trays shall be located as shown on the plans.

115-2.13 Plastic conduit. Plastic conduit shall comply with Item L-110, Airport Underground Electrical Duct Banks and Conduits.

115-2.14 Conduit terminators. Conduit terminators shall be pre-manufactured for the specific purpose and sized as required or as shown on the plans.

115-2.15 Pulling-in irons. Pulling-in irons shall be manufactured with 7/8-inch (22 mm) diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2-inch (12 mm) diameter with an ultimate strength of 270,000 psi (1862 MPa)). Where stress-relieved carbon steel roping is used, a rustproof sleeve shall be installed at the hooking point and all exposed surfaces shall be encapsulated with a polyester coating to prevent corrosion.

115-2.16 Ground rods. Ground rods shall be one piece, copper clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 10 feet long nor less than 3/4 inch in diameter. Extend #6 AWG solid, bare copper-clad grounding conductors to all appurtenances to be grounded. Connections shall be exothermic..

CONSTRUCTION METHODS

115-3.1 Unclassified excavation. It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the RPR without additional expense to the Owner.

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the 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.

All excavation shall be unclassified and shall be considered incidental to Item L-115. Dewatering necessary for structure installation and erosion per federal, state, and local requirements is incidental to Item L-115.

Boulders, logs and all other objectionable material encountered in excavation shall be removed. All rock and other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the RPR. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

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

Unless otherwise provided, bracing, sheeting and shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

After each excavation is completed, the Contractor shall notify the RPR. Structures shall be placed after the RPR has approved the depth of the excavation and the suitability of the foundation material.

Prior to installation the Contractor shall provide a minimum of 6 inches (150 mm) of sand or a material approved by the RPR as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

115-3.2 Concrete structures. Concrete structures shall be built on prepared foundations conforming to the dimensions and form indicated on the plans. The concrete and construction methods shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

115-3.3 Precast unit installations. Precast units shall be installed plumb and true. Joints shall be made watertight by use of sealant at each tongue-and-groove joint and at roof of manhole. Excess sealant shall be removed and severe surface projections on exterior of neck shall be removed.

115-3.4 Placement and treatment of castings, frames and fittings. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the RPR and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

Field connections shall be made with bolts, unless indicated otherwise. Welding will not be permitted unless shown otherwise on the approved shop drawings and written approval is granted by the casting manufacturer. Erection equipment shall be suitable and safe for the workman. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the RPR and approval of the method of correction shall be obtained. Approved corrections shall be made at Contractor's expense.

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

Pulling-in irons shall be located opposite all conduit entrances into structures to provide a strong, convenient attachment for pulling-in blocks when installing cables. Pulling-in irons shall be set directly into the concrete walls of the structure.

115-3.5 Installation of ladders. Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.

115-3.6 Removal of sheeting and bracing. In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than 6 inches (150 mm) of material is placed above the top of the structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with

selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

The RPR may direct the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

115-3.7 Backfilling. After a structure has been completed, the area around it shall be backfilled in horizontal layers not to exceed 6 inches (150 mm) in thickness measured after compaction to the density requirements in Item P-152. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

Backfill shall not be placed against any structure until approval is given by the RPR. In the case of concrete, such approval shall not be given until tests made by the laboratory under supervision of the RPR establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

Where required, the RPR may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

115-3.8 Connection of duct banks. To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

115-3.9 Grounding. A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches (150 mm) above the floor. The ground rod shall be installed within one foot (30 cm) of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch (100 mm) diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of one foot (30 cm) above the floor of the structure and separate from other cables. No. 2 American wire gauge (AWG) bare copper pigtailed shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. Hardware connections may be mechanical, using a lug designed for that purpose.

115-3.10 Cleanup and repair. After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound per MIL-P-21035. Surfaces shall be prepared and compound applied per the manufacturer's recommendations.

Prior to acceptance, the entire structure shall be cleaned of all dirt and debris.

115-3.11 Restoration. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective Item L-115 pay item.

The Contractor shall grade around structures as required to provide positive drainage away from the structure.

Areas with special surface treatment, such as roads, sidewalks, or other paved areas shall have backfill compacted to match surrounding areas, and surfaces shall be repaired using materials comparable to original materials.

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.

After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clear and in good condition.

115-3.12 Inspection. Prior to final approval, the electrical structures shall be thoroughly inspected for conformance with the plans and this specification. Any indication of defects in materials or workmanship shall be further investigated and corrected. The earth resistance to ground of each ground rod shall not exceed 25 ohms. Each ground rod shall be tested using the fall-of-potential ground impedance test per American National Standards Institute / Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81. This test shall be performed prior to establishing connections to other ground electrodes.

115-3.13 Manhole elevation adjustments. The Contractor shall adjust the tops of existing manholes in areas designated in the Contract Documents to the new elevations shown. The Contractor shall be responsible for determining the exact height adjustment required to raise or lower the top of each manhole to the new elevations. The existing top elevation of each manhole to be adjusted shall be determined in the field and subtracted/added from the proposed top elevation.

The Contractor shall remove/extend the existing top section or ring and cover on the manhole structure or manhole access. The Contractor shall install precast concrete sections or grade rings of the required dimensions to adjust the manhole top to the new proposed elevation or shall cut the existing manhole walls to shorten the existing structure, as required by final grades. The Contractor shall reinstall the manhole top section or ring and cover on top and check the new top elevation.

The Contractor shall construct a concrete slab around the top of adjusted structures located in graded areas that are not to be paved. The concrete slab shall conform to the dimensions shown on the plans.

115-3.14 Duct extension to existing ducts. Where existing concrete encased ducts are to be extended, the duct extension shall be concrete encased plastic conduit. The fittings to connect the ducts together shall be standard manufactured connectors designed and approved for the purpose. The duct extensions shall be installed according to the concrete encased duct detail and as shown on the plans.

METHOD OF MEASUREMENT

115-4.1 Non-aircraft-rated electrical and communication handholes shall be measured per each complete handhole installed in place and accepted. The following items shall be included in the price of each unit: All required excavation and dewatering; sheeting and bracing; all required backfilling with on-site materials; restoration of all

surfaces and finished grading and turfing; all required connections; temporary cables and connections; and ground rod testing

BASIS OF PAYMENT

115-5.1 The accepted quantity of non-aircraft-rated electrical and communication handholes shall be paid for at the Contract unit price per each, complete and in place. This price shall constitute full compensation for furnishing and installing the structure, lid/frame, bedding, grounding system, conduit terminations, fittings and appurtenances; excavation, dewatering, backfilling, compaction, testing, grading and restoration; and all labor, materials, equipment, tools and incidentals necessary to complete the installation as shown on the plans and specified herein.

Payment will be made under:

Item L-115-5.1 Non-Aircraft-Rated Electrical and Communication Handhole – per Each

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 National Standards Institute / Insulated Cable Engineers Association (ANSI/ICEA)

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

Advisory Circular (AC)

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 150/5345-42 Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories

AC 150/5340-30 Design and Installation Details for Airport Visual Aids

AC 150/5345-53 Airport Lighting Equipment Certification Program

Commercial Item Description (CID)

A-A 59544 Cable and Wire, Electrical (Power, Fixed Installation)

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

ASTM A897 Standard Specification for Austempered Ductile Iron Castings

ASTM C144 Standard Specification for Aggregate for Masonry Mortar

ASTM C150 Standard Specification for Portland Cement

ASTM C206 Standard Specification for Finishing Hydrated Lime

FAA Engineering Brief (EB)

EB #83 In Pavement Light Fixture Bolts

Mil Spec

MIL-P-21035 Paint High Zinc Dust Content, Galvanizing Repair

National Fire Protection Association (NFPA)

NFPA-70

National Electrical Code (NEC)

END OF ITEM L-115

Item L-125 Installation of Airport Lighting Systems

DESCRIPTION

125-1.1 This item shall consist of airport lighting systems furnished and installed in accordance with this specification, the referenced specifications, and the applicable advisory circulars (ACs). The systems shall be installed at the locations and in accordance with the dimensions, design, and details shown in the plans. This item shall include the furnishing of all equipment, materials, services, and incidentals necessary to place the systems in operation as completed units to the satisfaction of the RPR, Engineer, and Owner.

EQUIPMENT AND MATERIALS

125-2.1 General.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified under the Airport Lighting Equipment Certification Program in accordance with AC 150/5345-53, current version. FAA certified airfield lighting shall be compatible with each other to perform in compliance with FAA criteria and the intended operation. If the Contractor provides equipment that does not perform as intended because of incompatibility with the system, the Contractor assumes all costs to correct the system so it operate properly.

b. Manufacturer's certifications shall not relieve the Contractor of their responsibility to provide materials in accordance with 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, which do comply with these specifications, at the sole cost of the Contractor.

c. All materials and equipment used 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. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be clearly made with arrows or circles (highlighting is not acceptable). The Contractor shall be responsible for delays in the project accruing 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 submitted in electronic PDF format, tabbed by specification section. The RPR reserves the right to reject any or all equipment, materials or procedures, which, in the RPR's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. All LED light fixtures, with the exception of obstruction lighting (AC 150/5345-43) must be warranted by the manufacturer for a minimum of 4 years after date of installation inclusive of all electronics." Obstruction lighting warranty is set by the individual manufacturer.

EQUIPMENT AND MATERIALS

125-2.2 Conduit/Duct. Conduit shall conform to Specification Item L-110 Airport Underground Electrical Duct Banks and Conduits.

125-2.3 Cable and Counterpoise. Cable and Counterpoise shall conform to Item L-108 Underground Power Cable for Airports.

125-2.4 Tape. Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88 respectively, as manufactured by 3M Company or an approved equal.

125-2.5 Cable Connections. Cable Connections shall conform to Item L-108 Installation of Underground Cable for Airports.

125-2.6 Precision Approach Path Indicator (PAPI). The PAPI system shall be installed as shown on the plans and in accordance with FAA Order 6850.2C, FAA AC 150/5340-30, FAA AC 150/5345-28, manufacturer's installation instructions, and all applicable FAA standards.

The PAPI Lamp Housing Assemblies (LHAs) and Power and Control Assembly (PCA) shall be Owner-furnished. The Contractor shall receive, inspect, unload, store, protect, assemble, install, wire, ground, connect, test, and place the Owner-furnished equipment into complete operating condition as required by the respective Contract pay items.

Work associated with the PAPI system shall be divided among the Contract pay items as follows:

- a. **Installation of Owner-Furnished FAA 4-Box PAPI System:** Includes installation of the four Owner-furnished LHAs, frangible couplings, mounting hardware, final equipment connections, grounding and bonding associated with the LHAs, preliminary alignment, testing, FAA commissioning support, flight inspection support, and final aiming adjustments. PAPI foundations, PCC pads, PCA rack/support assembly, PCA rack foundation/mow pad, Glide Slope Shelter modifications, handholes, and separately measured conduit and conductors are excluded.
- b. **PAPI PCA Rack and PAPI Support System:** Includes the PCA rack/support structure, PCA rack foundation, PCC mow pad around the rack, mounting hardware and supports, grounding and bonding, conduit from the PCA rack to the PAPI units, power/control/ground wiring from the PCA rack to the PAPI units, connections and terminations at the Owner-furnished PCA, fittings, connectors, supports, testing, and incidentals required for a complete installation.
- c. **Shelter-to-PCA Infrastructure:** Underground conduit, conductors and handholes between the Glide Slope Shelter and PCA rack shall be measured and paid separately under Items L-108, L-110 and L-115.
- d. **Glide Slope Shelter Modifications:** Modifications within and immediately associated with the existing Runway 18R Glide Slope Shelter shall be measured and paid separately under the Glide Slope Shelter Modifications / PAPI Power Connection lump-sum pay item.
- e. **PAPI Foundations and PCC Pads:** PAPI structural foundations and PCC pads around the PAPI units shall be measured and paid separately under their respective Contract bid items.

125-2.7 PAPI PCA Rack and PAPI Support System, Provide a complete PCA rack/support assembly at the location shown on the Contract Drawings. The Owner-furnished PCA shall be installed on the rack/support assembly in accordance with the FAA requirements, manufacturer's requirements, and Contract Drawings.

The work shall include the rack/support structure, rack foundation, PCC mow pad, mounting hardware, supports, grounding and bonding, conduit, and conductors between the PCA rack and the four PAPI units, fittings, connectors, terminations, testing, and all appurtenances necessary for a complete and operational installation.

Conduit and conductors between the Glide Slope Shelter and PCA rack shall not be included in this item and shall be measured and paid separately under Items L-108 and L-110. Handholes shall be measured and paid separately under Item L-115.

125-2.8 Light Base and Transformer Housings. Light Base and Transformer Housings should conform to the requirements of AC 150/5345-42. Light bases shall be Type L-867, Class 1A, Size -B 12" diameter, 24" deep, shall be provided as indicated or as required to accommodate the fixture or device installed thereon. Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures.

125-2.9 Isolation Transformers. Isolation Transformers shall be Type L-830, size as required for each

installation. Transformers shall conform to AC 150/5345-47.

INSTALLATION

125-3.1 Installation. The Contractor shall furnish, install, connect and test all equipment, accessories, conduit, cables, wires, buses, grounds and support items necessary to ensure a complete and operable airport lighting system as specified here and shown in the plans.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and state and local code agencies having jurisdiction.

The Contractor shall install the specified equipment in accordance with the applicable advisory circulars and the details shown on the plans.

125-3.2 Testing. Upon completion of installation, the Contractor shall perform all required inspection, continuity, insulation resistance, grounding, functional, and operational tests in accordance with the Contract Documents, FAA Order 6850.2C, FAA Order 6000.204, FAA Order 6950.22, and other applicable FAA standards. All testing shall be witnessed by the Engineer and FAA Representative when required.

Prior to FAA commissioning, the Contractor shall demonstrate that:

- a. All conductors have passed insulation resistance testing.
- b. All grounding and bonding systems have been installed and tested.
- c. The PAPI system is fully operational and all LHAs operate properly.
- d. The PAPI LHAs have been installed at the required elevations and preliminary aiming angles shown on the plans.
- e. The PCA, power distribution equipment, and associated controls operate correctly.
- f. All deficiencies identified during testing have been corrected.

The Contractor shall coordinate with the Engineer, Owner, and FAA for commissioning and flight inspection. Final acceptance of the PAPI system shall not occur until successful completion of FAA commissioning, flight inspection, and acceptance by the Owner.

125-3.3 Shipping and Storage. Equipment shall be shipped in suitable packing material to prevent damage during shipping. Store and maintain equipment and materials in areas protected from weather and physical damage. Any equipment and materials, in the opinion of the RPR, damaged during construction or storage shall be replaced by the Contractor at no additional cost to the owner. Painted or galvanized surfaces that are damaged shall be repaired in accordance with the manufacturer's recommendations.

METHOD OF MEASUREMENT

125-4.1 Installation of Owner-furnished FAA 4-box Precision Approach Path Indicator (PAPI) System. Installation of the Owner-furnished FAA 4-box PAPI system shall be measured on a lump-sum basis. Measurement shall include receiving, inspecting, unloading, storing, protecting, assembling and installing the four Owner-furnished PAPI LHAs; frangible couplings; mounting hardware; equipment connections; grounding and bonding associated with the LHAs; preliminary alignment; testing; FAA commissioning and flight inspection support; final aiming adjustments; and miscellaneous appurtenances necessary to place the PAPI LHAs into complete operating condition.

PAPI concrete foundations, PCC pads around the PAPI units, PCA rack/support assembly, PCA rack foundation and mow pad, Glide Slope Shelter modifications, handholes, shelter-to-PCA conduit and conductors, and PCA-to-PAPI conduit and conductors shall not be measured under this item.

125-4.2 Runway 18R Glide Slope Shelter Modifications / PAPI Power Connection. Glide Slope Shelter modifications shall be measured on a lump-sum basis. Measurement shall include all modifications required within and immediately associated with the existing Glide Slope Shelter to establish the source connection for the new PAPI system, including shutdown coordination, existing equipment modifications, breakers/disconnects and power-distribution modifications shown on the plans, penetrations, sealing, firestopping, weatherproofing, terminations within the shelter, grounding and bonding, testing, labeling, and restoration.

Underground conduit, conductors, handholes, PCA rack/support assembly, and work beyond the exterior shelter connection point toward the PCA rack shall not be measured under this item.

125-4.3 PAPI PCA Rack and PAPI Support System. The PAPI PCA rack/support assembly shall be measured per each complete assembly installed in place and accepted. Measurement shall include the rack/support structure, rack foundation, PCC mow pad, mounting hardware and supports, grounding and bonding, conduit from the PCA rack to the PAPI units, power/control/ground conductors from the PCA rack to the PAPI units, connections and terminations at the Owner-furnished PCA, fittings, connectors, supports, testing, and incidentals necessary for a complete installation.

Shelter-to-PCA conduit, conductors and handholes shall not be measured under this item and shall be measured under Items L-108, L-110 and L-115.

BASIS OF PAYMENT

125-5.1 Installation of Owner-Furnished FAA 4-Box PAPI System. Payment shall be made at the Contract lump-sum price for installation of the Owner-furnished FAA 4-box PAPI system. This price shall constitute full compensation for receiving, inspecting, unloading, storing, protecting, assembling, installing, grounding, connecting, testing, preliminarily aligning, supporting FAA commissioning and flight inspection, performing final aiming adjustments, and placing the four Owner-furnished PAPI LHAs into operation, including all labor, tools, equipment and incidentals necessary to complete the work specifically assigned to this pay item.

No payment under this item shall be made for separately bid PAPI foundations, PCC pads, PCA rack/support assembly, PCA rack foundation/mow pad, Glide Slope Shelter modifications, handholes, shelter-to-PCA conduit/conductors, or PCA-to-PAPI conduit/conductors.

125-5.2 Runway 18R Glide Slope Shelter Modifications / PAPI Power Connection. Payment shall be made at the Contract lump-sum price and shall constitute full compensation for all labor, materials, equipment, tools, testing, shutdown coordination, modifications, connections, terminations, grounding/bonding, penetrations, sealing, labeling, restoration and incidentals necessary to establish the PAPI source connection within and immediately associated with the existing Glide Slope Shelter.

125-5.3 PAPI PCA Rack and PAPI Support System. Payment shall be made at the Contract unit price per each PCA rack/support assembly, complete in place and accepted. This price shall constitute full compensation for the rack/support structure, foundation, PCC mow pad, mounting hardware and supports, grounding/bonding, PCA-to-PAPI conduit and conductors, connections and terminations at the Owner-furnished PCA, fittings, connectors, testing, labor, materials, tools, equipment and incidentals required for a complete installation.

Payment will be made under:

Item L-125-5.1	Installation of Owner-Furnished FAA 4-Box Precision Approach Path Indicator (PAPI) System – per Lump Sum
Item L-125-5.2	Runway 18R Glide Slope Shelter Modifications / PAPI Power Connection – per Lump Sum
Item L-125-5.3	PAPI PCA Rack and PAPI Support System – per Each

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 150/5340-18	Standards for Airport Sign Systems
AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-5	Circuit Selector Switch
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 150/5345-28	Precision Approach Path Indicator (PAPI) Systems
AC 150/5345-39	Specification for L-853, Runway and Taxiway Retroreflective Markers
AC 150/5345-42	Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5345-44	Specification for Runway and Taxiway Signs
AC 150/5345-46	Specification for Runway and Taxiway Light Fixtures
AC 150/5345-47	Specification for Series to Series Isolation Transformers for Airport Lighting Systems
AC 150/5345-51	Specification for Discharge-Type Flashing Light Equipment
AC 150/5345-53	Airport Lighting Equipment Certification Program
Engineering Brief No. 67	Light Sources Other than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures

END OF ITEM L-125

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)



MSCAA Project No.: 25.1486-01
Foth Infrastructure & Environment, LLC Project No.: 26M300.25

MEM Runway 18R PAPI Installation

AUGUST 17, 2026

ISSUED FOR BID PLANS

Prepared for:
Memphis-Shelby County Airport Authority (MSCAA)
Fredrick W. Smith International Airport
Memphis, Tennessee

Prepared by:
Foth Infrastructure & Environment, LLC

**5100 Poplar Avenue Clark Tower Suite 2709A
Memphis TN, 38137**

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Appendix 1 - MSCAA Airport Security Plan

Purpose

Careful planning, scheduling, and coordination of construction activities can minimize disruption of normal aircraft operations and avoid situations that compromise the airport's operational safety. The CSPP is the culmination of that planning effort during the design of the project. Memphis/Shelby County Airport Authority (MSCAA) staff, the FAA, and critical stakeholders have provided input on this CSPP. It has been developed from guidance set forth in the FAA Advisory Circular 150/5370-2, *Operations Safety on Airports During Construction*. It is imperative that the provisions set forth in this plan be reviewed by the Contractor prior to mobilizing to the site and the document be followed without alteration.

Prior to mobilization, the Contractor must submit a Safety Plan Compliance Document (SPCD) describing how the Contractor will comply with the requirements set forth in this CSPP. An example SPCD is provided as an appendix to this document.

If the Contractor sees a need to alter the CSPP in any way, a request must be submitted to MSCAA, in writing, prior to the start of construction. Please note that changes to the CSPP may require coordination with all impacted parties and, potentially, a resubmittal to the FAA. This can be a 90–120 day process. If the change is accepted, it will be treated the same as any other change to the contract documents.

If the Contractor's activities do not comply with the provisions of this CSPP, the Contractor will be issued a written request to immediately cease the non-compliant action until a meeting can be held to discuss the issues and all necessary corrective actions, to be performed by the Contractor, are in place. Delays for non-compliance with the CSPP will not result in an extension of the allotted contract time for any phase of work or the total contract. All liquidated damage provisions set forth in the contract will still apply.

Scope of Work

Runway 18R-36L at MEM serves a significant portion of traffic, including Federal Express wide-body cargo aircraft and commercial operations. Although the 36L end of Runway 18R-36L has a precision approach path indicator (PAPI), currently there is no precision approach path indicator (PAPI) at the Runway 18R end. Given the intensity and complexity of operations, particularly due to Federal Express cargo operations, the lack of a PAPI presents operational and safety limitations during visual and non-precision approaches. The only other runway ends at MEM that lack a PAPI are Runway 18C, and Runway 9. Federal Express reached out to the Memphis-Shelby County Airport Authority (MSCAA) and requested that a PAPI be installed at Runway 18R.



The MSCAA will fund the procurement and installation of the PAPI, after which the FAA will assume ownership and maintenance once the system has been installed and commissioned. The PAPI will be a newer LED-style unit manufactured by New Bedford Panoramex. Due to anticipated lead times, the MSCAA will procure the PAPI from the FAA as an item in an FAA reimbursable agreement (RA).

The scope of work of the Project will be installed by a Construction Contractor, under contract with MSCAA. Major scope of work elements of the Runway 18R PAPI Installation Project, divided by party installing the elements, include:

a. MSCAA Construction Contractor:

- Excavation for and installation of PCC foundations for PAPI PCA rack and PAPI Light Housing Assembly (LHA) units. Includes PCC maintenance pad around the PAPI PCC foundations.
- Installation of PAPI PCA rack and MSCAA-provided PAPI LHA Units (4 Units Total)
- Power duct banks and communication duct banks between PAPI PCA Rack and the PAPI LHA units
- Power cable installation in 2 way – 2" schedule 80 PVC conduit from glide slope shelter to PAPI PCA rack and lights.
- Installation of power cable and communication cable in separate communication duct banks and power duct banks between PAPI PCA rack and PAPI LHA units.

- Installation of Electric Manhole and Communication handholes.
- Topsoil and sodding.

Coordination

Airport operational safety during construction will be discussed at the pre-design, pre-bid, and pre-construction conferences. Construction progress meetings and meetings with the FAA Air Traffic Organization (ATO) will be coordinated as required throughout the contract.

The Contractor must provide contact information for key construction personnel prior to the start of the project. MSCAA will add engineering staff and key airport personnel to this list and it will be distributed to all relevant parties. Updated and current contact lists must be submitted if personnel change.

1. Prebid Conference

A pre-bid conference will be held for prospective bidders to ask questions and visit the site.

2. Preconstruction Conference

A pre-construction conference will be held prior to issuance of Notice to Proceed. Attendees will include MSCAA Engineering Staff, MSCAA Operations Staff, local air traffic control management (if necessary), MSCAA Maintenance Staff, Engineer of Record, Engineer Field Staff (RPR), Contractor Project Superintendent, and Contractor Foreman, as well as the project foreman for each subcontractor employed by the prime Contractor. The agenda for this preconstruction conference will include a review of this CSPP.

3. Construction Progress Meetings

Construction progress meetings will be held throughout the duration of the project. Attendees will include MSCAA Engineering Staff, MSCAA Operations Staff, Prime Contractor, Project Superintendent and/or Foreman, and Engineer of Record and/or Engineer Field Staff (RPR). Local air traffic control management as well as airport tenants will be invited as needed, based on the project work impacting their operations on a week-to-week basis. Construction phasing and safety will be a standing agenda item at the weekly construction progress meetings.

4. Daily Coordination

At all times when construction activities are being performed on this project, the prime Contractor must have a foreman on-site who is authorized to make decisions regarding the operations and safety of all personnel employed by the Contractor and Subcontractors. The designated foreman will meet with Airport Operations Staff as work items being performed require.

5. ATCT Coordination

Coordination with ATCT will be as needed during the project. Only properly badged personnel with Class 3 driving privileges, Engineer Field Staff (RPR), or MSCAA will contact the ATCT during the project. The MEM Ground frequency is 121.9 MHz.

6. CSPP Modifications

Proposed changes and substantial delays will require additional coordination with the airport and the FAA for the purpose of evaluating possible revisions to the CSPP. FAA shall approve of all proposed CSPP changes prior to execution.

Phasing

1. Locations, Durations, and Sequence of the Work

All work for each phase shall be completed in accordance with the project phasing plans, the project technical specifications, this CSPP, and the Contractor submitted SPCD.

The project has a duration of **34** calendar days and consists of 2 Phases. A calendar day is defined as any day on the calendar. It includes Saturdays, Sundays, Holidays, and non-workdays. Refer to the project plans for graphical depictions of the phases along with notes on phase-specific sequencing and operational requirements. In general, the phases are as follows:

a. Phase 1

Phase 1 work has a duration of 34 calendar days and has no subphases. All Phase 1 construction is outside the Runway 18R-36L runway safety area and does not require any closures of Runway 18R-36L. Work items to be completed in this phase includes the construction necessary for the PAPI power connection to the Glide Slope shelter, the installation of the PAPI PCA rack, conduit installation and utility line installation from the FAA glide slope shelter to the PAPI PCA rack, manhole installation outside the runway safety area, and any conduit installation between the PAPI PCA rack and the PAPI **outside** the runway safety area. Also includes excavation for and installation of the PAPI PCA rack foundation. Phase 1 construction may occur 7 days a week.

b. Phase 2

Phase 2 work has a duration of 20 calendar days and has no subphases. Phase 2 must be completed during a series of closures for Runway 18R-36L. The closures are limited to the following times: 6:00 pm Sunday - 9:00 pm Monday (27-hour closure) and Tuesday - Friday: 6:00 am - 3:30 pm (9.5-hour closure each day). 3 total 27-hour closures are available within the Phase 2, 20 calendar day duration. Phase 2 work will occur concurrently with Phase 1 work as the 20 calendar day Phase 2 work must be completed with the Phase 1, 34 calendar day duration. Work items to be completed in this phase include the excavation for and installation of the foundations for the PAPI LHA units, installation of conduit and cable necessary for the PAPI units inside the runway safety, construction of the PCC pad around the PAPI foundations, and installation of the MSCAA provided PAPI LHA units.

c. Early Start Date – The project has an anticipated start date of Sunday, October 11, 2026 (pending issuance of Notice to Proceed).

Affected Areas of Operations

1. Operational Affect Table

OPERATIONAL REQUIREMENT	NORMAL	PHASE 1	PHASE 2
Runway 18L-36R	9,000' length; ADG D-V	No Change	No Change
Runway 18C-36C	11,120' length; ADG D-V	No Change	No Change
Runway 18R-36L	9,320' length; ADG D-V	No Change	Closed During Daytime Closures
Runway 9-27	8,946' length; ADG D-V	No Change	No Change
Taxiway A	ADG V	No Change	No Change
Taxiway A1	ADG V	No Change	No Change
Taxiway A2	ADG V	No Change	No Change
Taxiway B	ADG V	No Change	No Change
Taxiway C (FEDEX to TW C5)	ADG VI	No Change	No Change
Taxiway C (TW C5 to TW D)	ADG IV	No Change	No Change
Taxiway C (TW D to TW E)	ADG V	No Change	No Change
Taxiway C1	ADG V	No Change	No Change
Taxiway C2	ADG V	No Change	No Change
Taxiway C3	ADG V	No Change	No Change
Taxiway C4	ADG V	No Change	No Change
Taxiway C5	ADG V	No Change	No Change
Taxiway C6	ADG VI	No Change	No Change
Taxiway C7	ADG VI	No Change	No Change
Taxiway D (TW C to RW 18L)	ADG V	No Change	No Change
Taxiway D (RW 18L to TW Y)	ADG VI	No Change	No Change
Taxiway E	ADG V	No Change	No Change
Taxiway H (TW N to TW J)	ADG VI	No Change	No Change
Taxiway H (TW J to RW 36R)	ADG V	No Change	No Change
Taxiway H (RW 36R to TW Y)	ADG VI	No Change	No Change
Taxiway J (TW L to TW U)	ADG III	No Change	No Change
Taxiway J (TW U to TW R)	ADG V	No Change	No Change
Taxiway K	ADG V	No Change	No Change
Taxiway L (TW J to TW C)	ADG III	No Change	No Change
Taxiway L (TW C to TW S)	ADG V	No Change	No Change
Taxiway M	ADG V	No Change	No Change
Taxiway M1	ADG V	No Change	Closed During Daytime Closures
Taxiway M2	ADG V	No Change	Closed During Daytime Closures
Taxiway M3	ADG V	No Change	Closed During Daytime Closures
Taxiway M4	ADG V	No Change	Closed During Daytime Closures
Taxiway M5	ADG V	No Change	Closed During Daytime Closures

Taxiway M6	ADG V	No Change	Closed During Daytime Closures
Taxiway M7	ADG V	No Change	Closed During Daytime Closures
Taxiway M8	ADG V	No Change	Closed During Daytime Closures
Taxiway M9	ADG V	No Change	Closed During Daytime Closures
Taxiway N (TW V to TW M)	ADG V	No Change	No Change
Taxiway N (TW M to TW M6)	ADG IV	No Change	No Change
Taxiway N (TW M6 to TW M1)	ADG V	No Change	No Change
Taxiway P (TW M to RW 18L)	ADG V	No Change	No Change
Taxiway P (RW 18L to ANG)	ADG VI	No Change	No Change
Taxiway P1	ADG V	No Change	No Change
Taxiway P2	ADG V	No Change	No Change
Taxiway R (TW N to TW J)	ADG VI	No Change	No Change
Taxiway R (TW J to RW 36R)	ADG V	No Change	No Change
Taxiway R (RW 36R to TW Y)	ADG VI	No Change	No Change
Taxiway R1	ADG VI	No Change	No Change
Taxiway R2	ADG VI	No Change	No Change
Taxiway S	ADG V	No Change	No Change
Taxiway S1	ADG V	No Change	No Change
Taxiway S2	ADG V	No Change	No Change
Taxiway S3	ADG V	No Change	No Change
Taxiway S4	ADG V	No Change	No Change
Taxiway S5	ADG V	No Change	No Change
Taxiway T	ADG V	No Change	No Change
Taxiway U	ADG V	No Change	No Change
Taxiway V (TW B to TW V2)	ADG IV	No Change	No Change
Taxiway V (TW C to TW B)	ADG V	No Change	No Change
Taxiway V (TW N to TW C)	ADG VI	No Change	No Change
Taxiway V1	ADG V	No Change	No Change
Taxiway V2	ADG V	No Change	No Change
Taxiway V3	ADG VI	No Change	No Change
Taxiway Y (TW V to RW 27)	ADG IV	No Change	No Change
Taxiway Y (RW 27 to TW R)	ADG VI	No Change	No Change
Taxiway Y1	ADG VI	No Change	No Change
Taxiway Y2	ADG VI	No Change	No Change
Taxiway Y3	ADG VI	No Change	No Change

Navigational Aid (NAVAID) Facilities

Aircraft Navigational Aids provide visual and electronic information that is used by pilots who operate and land aircraft at the airport. Construction activities can have negative impacts on the functionality and serviceability of NAVAIDS.

There are no anticipated impacts to NAVAIDS associated with this project. During Phase 1 when Phase 2 construction is not occurring, the contractor cannot stage equipment or vehicles within the Runway 18R glide slope critical area just north of the Runway 18R glide slope as Runway 18R-35L will be open.

The contractor must coordinate their work effort and limit their operations so that NAVAIDS are not impacted. Planned NAVAID impacts must be addressed in the Contractor's construction schedule. The Contractor is required to provide a 45-day notice to the MSCAA Operations Manager and the MSCAA Project Engineer.

Contractor Access

1. Stockpiled Materials/Staging Location

Stockpiled materials and equipment storage are not permitted within active Safety Areas (RSA/TSA), Object Free Zones (OFZ), and Object Free Areas (OFA) of an operational runway or taxiway. Staging and stockpile location(s) are shown in the plans and may be located within the AOA.

There are two (2) staging areas for this project:

1. Contractor may stage material and equipment less than 10 ft in height in the grassy area between the perimeter road embankment and the Runway 18R-36L object free area, south of the Runway 18R glide slope shelter. Safety fence shall be installed to delineate the object free area, and on the west side of the staging area between the perimeter road and the staging area.
2. There is an existing staging area located to the SE of the Runway 36L threshold. The existing fence to the west and north of the staging area is a non-AOA boundary fence (this fence is 8' tall with barb wire on top, but not an AOA boundary). Height limits in this area is 40 ft.

Stockpiles are limited to maintain a clear line of sight from the Air Traffic Control Tower to all active taxiways and runways. Stockpile locations shall not be located over any MSCAA or FAA electrical/communications infrastructure.

a. Height

Stockpile height limits for materials will be 10 feet, located outside the runway safety area. No stockpiles allowed within the Runway 18R-36L object free area.

b. Wildlife Attractant

The Contractor must manage stockpiles so that they do not attract wildlife (Refer to Wildlife Management Section below).

No person shall enter upon the Air Operations Area (AOA) or any other restricted area except Contractors that have been authorized and have completed security badge training and have been assigned to duty therein, or personnel escorted by an appropriately badged escort.

b. Mechanisms to Prevent Improper Movement

Contractor operations within the AOA are limited to the areas shown on the project phasing plans. A visual boundary will be installed by the Contractor around the work area. The boundary will consist of orange traffic cones on pavement surfaces (when closed) at runway safety area. Additionally, the boundary will consist of high-visibility orange safety fence on turfed surfaces, installed as shown on detail in project plans. The project phasing plans show the location of the work area boundary. Construction vehicles and personnel shall not cross safety cones without an approved escort.

c. Parking Areas for Personal Vehicles and Equipment

Contractor employee personal vehicles shall be parked outside of the AOA. Employee parking shall be located at the staging area SE of Runway 36L. Contractor employee personal vehicles shall not be driven inside the AOA. Contractor vehicles and equipment are allowed inside of the project work area within the AOA. Equipment staging/parking areas are shown on the project phasing plans and must be approved in advance by the MSCAA.

d. Haul Routes

The phasing plan sheets depict the haul route from adjacent public roadways on the south side south of the airfield, to the project work area through the airport perimeter fence. Contractor access and hauling operations are strictly limited to the haul route shown, which is the perimeter road to the south and west of Runway 18R-36L, and the FAA access drive to the Runway 18R Glide Slope Shelter. Prior to the start of construction, the Contractor, Engineer and Owner will review haul routes and document existing condition. Following completion of construction, the Contractor, Engineer, and Owner will review haul routes and document condition. The Contractor is required to restore any temporary haul routes to original condition. Contractor will be escorted from the AOA entry point at Gate CD-9 to the project work area.

e. Contractor Vehicle Marking and Lighting

Each Contractor licensed vehicle must display a company logo on both sides of sufficient size to be recognizable to personnel in the control tower. Signs must be a minimum of 200 square inches and be approved by the airport. Specialized construction equipment does not require signs. Each Contractor licensed vehicle must have a yellow/amber rotating beacon affixed to the uppermost part of the vehicle. Lights must be visible from any direction, including the air. Construction equipment does not require rotating beacon lights during day operations, provided an aircraft warning flag is displayed at the highest point of the equipment. Contractor vehicle marking and lighting is the sole responsibility of the Contractor. The airport will not provide markings, flags, or lights.

3. Radio Communications

a. Two-Way Radios

Contractors may utilize two-way radios on the project provided that they do not interfere with existing Airport and FAA communication equipment and frequencies.

b. Air Traffic Control (ATC) Radio Communication

For this project, when the Contractor requires access to the movement area, staff with Class 3 driving privileges or the Engineer Field Staff (RPR) will communicate with ATCT.

4. Airport Security

- a. The Memphis-Shelby County Airport Authority (MSCAA) conducts its security operations in a serious manner and incorporates its mandated security directives to the letter. The management of the Airport fully expects all Tenants and Contractors to help enforce security regulations. The MSCAA strictly enforces the requirements on issuance and use of Airport identification/access media. Companies and individuals found to be in non-compliance with rules and regulations outlined in this manual may face revocation of access privileges and/or prosecution. The Contractor shall comply with all security requirements as outlined in the contract documents.
- b. The Contractor shall provide any necessary security at staging/storage locations, employee parking areas, and the work areas. Employee parking is allowed at the staging area located to the SE of Runway 36L. This location is inside the AOA fence. Firearms are prohibited in Contractor employee vehicles parking at the staging area inside the AOA fence. Any Contractor employee vehicle that is found to have firearms will have their parking privileges revoked, even if the firearms were in the vehicle inadvertently. No employee parking is allowed at the staging area south of the Runway 18R Glide Slope shelter.

5. TSA Requirements

The Transportation Security Administration (TSA) through several Transportation Security Regulations (TSR) has the regulatory power to assess fines for breaches of airport security. The TSA will test the Contractors security means and methods for compliance with applicable security codes and regulations throughout the course of the project. Accordingly, if the Contractor is found culpable for security breaches, fines assessed to the Airport will be collected from the Contractor.

6. Security Badging Requirements

The Contractor will be required to obtain security badging in accordance with the requirements in the Specification.

7. Contractor Access

The Contractor shall be responsible for controlled access to the work site. The Contractor shall provide and manage security/badged personnel at proposed access locations.

Wildlife Management

1. Trash

Food scraps must be collected from construction personnel activity continuously.

2. Standing Water

Any activity taking place that creates a standing body of water must be remedied within 24 hours.

3. Tall Grass and Seeds

If needed within the project area, the contractor shall be responsible for mowing the grass within their work areas. Mowing schedules have been established to maintain, when possible, a height of 6 to 10 inches to help prevent large flocks of starlings, crows, and other species from becoming a hazard. It will be the responsibility of the Contractor to establish and maintain a schedule that allows a maximum grass height of 10 inches within the construction work area.

4. Poorly Maintained Fencing and Gates

Periodic perimeter fence inspections are required by the Contractor to ensure the fence by Gate CD-9A is secured. Fence inspections performed by the contractor shall be within the vicinity of the project area, staging area, and site access points. Any issues shall be reported to MSCAA Operations or the MSCAA Project Engineer. These inspections also include identifying any animal digs that are located under the fence and ensuring that perimeter gates and drainage grates are tightly secured to prevent animal access. In addition, Contractors will take appropriate actions to reduce any other observed wildlife activity.

5. Disruption of Existing Wildlife Habitat

While this will frequently be unavoidable due to the nature of the project, Contractor personnel should immediately notify airport operations of a wildlife sighting.

Foreign Object Debris (FOD) Management

1. Description of FOD

Foreign object debris at airports includes any object found in an inappropriate location that can damage aircraft, equipment, or airport personnel. On construction sites, FOD typically is comprised of loose gravel, blowing sand, dust, wire bristles from sweeper heads, food wrappers, and material packaging. The presence of FOD on an airport's air operations area (AOA) poses a significant threat to the safety of air travel. FOD has the potential to damage aircrafts during critical phases of flight, which can lead to catastrophic loss of life and airframe, and at the very least increased maintenance and operating costs.

2. Methods of FOD Control

a. Training

The Contractor shall provide training to all employees working within the AOA on effective FOD management. Training shall include description and consequences of FOD, FOD awareness, and housekeeping procedures.

b. Housekeeping

Preventing FOD from occurring is the most effective form of FOD management. The Contractor must monitor construction activities and proactively develop a plan to prevent FOD from occurring. Typical FOD prevention measures include the use of covered trash containers, covered loads, zero tolerance of littering, and tying down items which may be easily wind-blown.

c. Ground Vehicle Tire Inspections

Prior to entering active airfield pavement, the Contractor must perform a vehicle tire check for any loose rocks that may be in the tread. Tires covered in mud must be cleaned prior to entering active airfield pavement in order to prevent tracking of dirt.

d. Pavement Inspections

Prior to opening completed portions of pavement work to airport operations, the Contractor shall keep the entire pavement surface clean and to the satisfaction of the Owner. Work areas will be inspected and approved by the MSCAA prior to opening the area to aircraft operations. This includes conducting a FOD walk with the RPR and MSCAA operations staff prior to opening.

e. FOD Inspections

Refer to Inspection Requirements section for FOD inspection requirements. The Contractor shall keep the project site and vehicles clean, employing a "clean as you go" approach throughout the project.

Hazardous Material Management

1. Haz-Mat Procedures

Haz-Mat Procedures are to be developed by the Contractor and submitted to the Engineer for review and Owner's records, including but not limited to:

- a. Fuel Storage Locations
- b. Spill Procedures
- c. Safety Data Sheet (SDS) - All applicable SDS must be readily available at the work site.

All temporary fuel storage tanks brought to the site must be double walled and placed in secondary containment. In addition, the tanks must be permitted by the fire marshal prior to use.

Notification of Construction Activities

1. List of Responsible Representatives

Persons who have questions concerning policies, procedures, or requirements of the Airport Security Program, should contact Airport Administration. Persons who observe a security violation, suspicious act, or any serious act that may endanger persons or property should immediately contact Airport Public Safety.

- a. Emergency (901) 922-8333
- b. MSCAA Emergencies (901) 922-8333
- c. MSCAA Operations Center (901) 922-8117
- d. MSCAA Communication Center (901) 922-8298
- e. NAVAID Emergency Contract 1-866-432-2622

2. Local FAA Tech Ops

In the event of an issue with any adjacent FAA NAVAID equipment (glide slope, localizer MALSR, ALSF, etc), and the RPR cannot be noticed, please contact an employee from the local FAA Tech Ops. Contract information is shown below.

- Chris Williams (901) 463-6753 (Christopher.D.Williams01@faa.gov)

3. NOTAMs

Contractor shall coordinate with the Engineer Field Staff (RPR) and Airport Operations personnel for the issuance of all NOTAMs related to the project construction. Airport Operations and FAA shall generate and issue NOTAMs based on Contractor construction schedules and facility impacts.

An FAA flight check is required at the completion of the project for PAPI commissioning. Any NOTAMs required for the flight check will be coordinated with Airport Operations.

4. Emergency Notification Procedures

In the case of a life-threatening situation, dial (901) 922-8333 and Airport Public Safety immediately thereafter. Airport Public Safety will coordinate any emergency response.

5. Aircraft Emergencies

In the event of an aircraft emergency, the Engineer Field Staff (RPR) will coordinate with Aircraft Rescue and Fire Fighting (ARFF) and the FAA and all construction personnel shall stop work and wait for direction from Airport Public Safety. In the event evacuation is requested, personnel shall immediately vacate the work site, secure construction access gate(s), and return when cleared by Airport Public Safety.

6. Coordination with ARFF Personnel

The Contractor must coordinate, through the RPR, with ARFF personnel, mutual aid providers, and other emergency services if construction requires the following:

- a. The deactivation and subsequent reactivation of water lines or fire hydrants.
- b. The re-routing or blocking of emergency access routes.
- c. The use of hazardous materials on the airfield.

Inspection Requirements

1. FOD Inspection

During construction, the Contractor shall continuously monitor for FOD and remove immediately.

2. Contractor Inspection

- a. Prior to opening completed work areas and pavement to aircraft operations, the contractor shall coordinate with Airport Operations for inspection of the work area. Pavements must be free of all dirt, sand, gravel, wire bristles, or any other objects that could cause damage to aircraft engines. All soil areas must be free of dirt clods, ruts, or surface irregularities that could damage an aircraft should it leave the pavement.

- b. All trenches and excavations within the runway safety area (RSA) must not be left open once Runway 18R-36L reopens. Trenches must be backfilled and compacted to match the existing grade before leaving the site. Steel plates may be used as an alternative provided the lip between the steel plate and adjacent ground is 3" or less. It is recommended that the contractor must not excavate more than can be backfilled and compacted during one work day. This includes foundations for the PAPI units.
- c. Daily inspections shall be completed to assure all traffic control devices are in proper locations and working order.

3. Airport Operations Inspection

The MSCAA staff will conduct pavement inspections prior to opening any pavement to aircraft operations. The MSCAA will also be inspecting the construction within the runway safety area (Phase 2 work) prior to re-opening the runway at the end of each runway closure. See Note 2.b above for safety area requirements prior to re-opening Runway 18R-36L.

4. Final Inspections

Before re-opening closed sections of the airport to operations, the Contractor, Airport Operator, and Engineer Field Staff (RPR) shall inspect the area. Upon their concurrence that the area is safe to operate aircraft, the area will re-open.

Underground Utilities

Special attention shall be given to preventing unscheduled interruption of utility services and facilities. It is the Contractor's responsibility to locate all existing utilities and underground airport facilities that may be affected by this project and to verify their exact location and elevation prior to commencing work.

Electrical cables, telecommunication lines, overhead electrical lines, FAA communication lines, jet fuel lines, sanitary sewer lines, storm water lines, gas lines, and water lines may be located in the limits or vicinity of work limits. Utilities interfering with construction shall be reset or relocated by the Contractor or utility company concerned, unless noted otherwise. The Contractor shall give proper notice to all utility companies and facility owners regarding removal/relocation or when working in the vicinity of utility lines and airport facilities.

The Contractor shall call Tennessee 811 and submit a completed MSCAA On Airport Utility Locate Request form to the Engineer Field Staff (RPR) 72 hours prior to digging on site. The Contractor will verify with all parties the location of all utilities before digging begins. Prior to digging near a utility, the contractor shall pothole the utility to physically verify its location and depth. The Contractor shall use extreme care in digging around the utility so as not to cause any damage to the utility. All subcontractors performing excavation activities shall follow the same procedures as outlined above.

Penalties

The following penalties will be administered by the Airport, FAA, and Transportation Security Administration (TSA) as allowed per the requirements of the Construction Safety and Phasing Plan.

1. Airport Security Plan (Badge Usage and Access, Escorting, etc).

Refer to attached Appendix 1, MSCAA Airport Security Plan, for badging and escorting policies at MEM. Section F of the Airport Security Plan summarizes penalties for violations.

2. Runway Incursions

In addition to the penalties for violations outlined in the attached Airport Security Plan, the penalties in the table below will be assessed for runway incursions. A runway incursion is any unauthorized intrusion onto a runway, regardless of whether or not an aircraft presents a potential conflict:

Runway Incursion Category	Description	Penalty
Category A	A serious incident in which a collision was narrowly avoided.	\$1500 and Rescission of Access to the AOA
Category B	An incident in which separation decreases and there is a significant potential for collision, which may result in a time critical corrective/evasive response to avoid a collision.	\$500 and Rescission of Access to the AOA
Category C	An incident characterized by ample time and/or distance to avoid a collision.	Rescission of Driving Privileges
Category D	An incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.	Written Warning

Violations of the CSPP outside of runway incursions will be assessed a written warning for the first violation and then \$500 per violation thereafter.

3. Returning Airport Badge

All security badges issued by the MSCAA Identification Office are the property of the Memphis-Shelby County Airport Authority and must be returned upon expiration, separation of employment (for any reason), when job function no longer requires an airport-issued security badge, and/or upon demand from the MSCAA. Retainage will not be related until all badges have been returned at the end of the project. Any misuse or willful failure to return a security badge is punishable by criminal prosecution. Security badges are non-transferable and must be used only by the person to whom they are issued. The security badge must be returned to the Company manager/supervisor at the end of employment and, in turn, by the Company to the MSCAA Identification Office.

4. Driver—Restricted Areas

All restricted area (SIDA/AOA) drivers shall possess and carry a valid US driver's license while driving on MSCAA restricted area roadways. Each driver is required to receive behind the wheel driver's training on the SIDA/AOA by their Employer and must take and successfully pass the written examination administered by the MSCAA at the security training class.

5. Releasing Airport Security Information

No person issued a security badge may divulge any information concerning an act of unlawful interference with civil aviation if such information is likely to jeopardize the safety of domestic or international aviation, or regarding any airport or airport tenant's security system to unauthorized persons.

6. Lost, Stolen, or Misplaced Security Badges

Immediately report to the Airport Authority by all means available NO EXCEPTIONS. Report to the ID Office 901-922-8788; if outside normal business hours, report to the MSCAA Communication Center at 901-922-8298. You must speak with Airport Security Personnel to report the unaccounted-for Security Badge.

7. Authority and Legal Action

The airport public safety department and designated airport security coordinators can issue violations resulting from poor or improper driving or security procedures. It is also the responsibility of all badge holders to notify public safety immediately when a possible breach in security has occurred.

8. FOD

The airport has a zero-tolerance approach to FOD, and the Contractor may be subject to fines from the Airport, FAA, or other agencies for failure to properly manage FOD during construction activities.

Special Conditions

In the case of an aircraft in distress or an accident, all Contractor personnel must remove all equipment from the project site and return to the staging area. The project will be suspended until clearance is given from the Engineer Field Staff (RPR) and the Airport Operator. In the event of a V/PD, the project will be suspended until a safety meeting and de-briefing of the incident occurs. In the event of a declared severe weather event, including an event requiring low-visibility operations/surface movement guidance and control system (LVO/MGCS) procedures, airport operations personnel may request the Contractor to temporarily suspend operations and vacate the premise until the event is over.

Runway and Taxiway Visual Aids—Marking, Lighting, Signs, and Visual Aids

Areas where aircraft will be operating are clearly and visibly separated from construction areas. Throughout the duration of the construction project, verify that these areas remain clearly marked and visible at all times.

1. General

Airport markings, lighting, signs, and visual NAVAIDs must be clearly visible to pilots and not be misleading, confusing, or deceptive. All must be secured in-place to prevent movement by prop wash, jet blast, wing vortices, or other wind currents and constructed of materials that would minimize damage to an aircraft in the event of inadvertent contact.

2. Markings

Markings must be in compliance with the standards of AC 150/5340-1, Standards for Airport Markings.

a. Temporary Closed Runways

For the Runway 18R-36L closures during Phase 2, place MSCAA-provided lighted 'X' at each end of the runway directly on or as near as practicable to the runway designation numbers. Contractor will be required to place the lighted 'X' at the start of each runway closure, and contr

actor will also be required to remove the lighted 'X' at the end of each runway closure.

b. Temporary Closed Taxiways

Place contractor-provided cones at the connecting taxiways between Runway 18R-36L and Taxiway M at the runway hold. Contractor will be required to place the cones at the start of each runway closure, and contractor will also be required to remove the cones at the end of each runway closure.

c. Temporary Closure X

No Temporary Closure 'X's are required with this project.

d. Temporary Markings

No Temporary markings are required with this project.

3. Lighting and Visual NAVAIDs

Lighting must be in conformance with AC 150/5340-30, Design and Installation Details for Airport Visual Aids, and AC 150/5345-50, Specifications for Portable Runway and Taxiway Lights. Temporarily deactivating runway and taxiway edge light is not required as part of this project. Temporary wiring to deactivate airfield circuits within closed portions of taxiways is also not required as part of this project.

4. Temporarily Closed Runways

As noted in Section 2 on the previous page, contractor to install MSCAA-provided Lighted 'X', at each end of the runway at the start of each daily closure, facing the approach.

5. Partially Closed Runways and Displaced Thresholds

There will be no partially closed runway during the course of this project.

6. Temporarily Closed Taxiways

There will be no temporarily closed taxiways during the course of this project.

7. Temporary Signs

Temporary construction signs are not required as part of this project.

Marking and Signs for Access Routes

Pavement markings and signs for construction personnel will conform to AC 150/5340-18 and, to the extent practicable, with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or state highway specifications.

Hazard Marking, Lighting, and Signing

- a. Low profile barricades with flashing red lights will be used at the perimeter of all pavement closures. Barricade spacing shall be as shown on the plans. Refer to the phasing plans for exact locations of low-profile barricades. Barricade placement and operation of flashing red lights shall be checked daily, at a minimum, for proper placement and operation and fixed immediately upon discovery of any deficiencies.

- b. All construction vehicles shall have an amber rotating beacon and signage.
- c. All construction equipment shall have an orange and white aircraft warning flag.
- d. All tall construction equipment shall have a red obstruction light in addition to an orange and white aircraft warning flag.
- e. The Contractor shall provide a representative on-call 24-hours a day for emergency maintenance of hazard marking, barricades, lighting and signage.

Work Zone Lighting

All work is anticipated to be constructed during daytime hours. If a need for night work arises, the Contractor must submit a work zone lighting plan to the RPR.

Protection of Runway and Taxiway Safety Areas

Runway Safety Areas (RSA), Taxiway Safety Areas (TSA), Obstacle Free Zones (OFZ), Object Free Areas (OFA), and approach surfaces must be protected during construction and are shown on the plan sheets. Protection of these areas includes limitations on the locations and height of equipment and stockpiled material. See the plan sheets of the CSPP for locations and dimensions of the protected areas.

1. Runway Safety Area (RSA) and Taxiway Safety Area (TSA)

A runway safety area is the defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. A taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. Construction activities within the existing RSA and TSA are subject to the following conditions:

- a. No construction may occur within the existing RSA or TSA while the corresponding runway or taxiway is open for aircraft operations.
- b. Open trenches or excavations are not permitted within the RSA or TSA while the corresponding runway or taxiway is open. If possible, backfill trenches before the runway or taxiway is opened. If the runway or taxiway must be opened before the excavations are backfilled, cover the excavations appropriately. Covering for open trenches must allow safe operation of the heaviest aircraft operating on the runway or taxiway across the trench without damage to the aircraft. Construction Contractors must prominently mark open trenches and excavations at the site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.
- c. Soil erosion must be controlled to maintain RSA and TSA standards. The RSA and TSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions of supporting the occasional passage of aircraft without causing structural damage to the aircraft.

2. Runway Object Free Area (ROFA)

Construction, including excavations, may be permitted in the ROFA. However, equipment must be removed from the ROFA when not in use, and material should not be stockpiled in the ROFA if not necessary. The staging area south of the Runway 18R glide slope shall be located outside the ROFA.

3. Taxiway Object Free Area (TOFA)

Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway object free area during normal operations. Thus, the restrictions are more stringent. Except as provided below, no construction may occur within the TOFA while the taxiway is open for aircraft operations.

- a. No construction will occur within any active taxiway object free areas.

4. Obstacle Free Zone (OFZ)

In general, personnel, material, and/or equipment may not penetrate the OFZ while the runway is open for aircraft operations. If a penetration to the OFZ is necessary, it may be possible to continue aircraft operations through operational restrictions.

5. Runway Approach/Departure Areas and Clearways

All personnel, materials, and/or equipment must remain clear of the applicable threshold siting surfaces as shown on the plan sheets of the CSPP. Objects that do not penetrate these surfaces may still be obstructions to air navigation. All construction for this project will be clear of any threshold siting surfaces.

Other Limitations on Construction

- a. Tall equipment used by the Contractor requires airport approval and a 7460-1 determination letter issued by the FAA for such equipment.
- b. All Contractor's construction equipment shall require an orange and white flag.
- c. The use of open flame welding or torches is prohibited unless fire safety precautions are provided and airport operations has approved their use. A hot work permit must be obtained and the airport's Hot Work Program followed. Hot work permits can be obtained Monday-Friday during regular business hours by contacting the MSCAA Building Maintenance Supervisor at (901) 922-2279.
- d. The use of electrical blasting caps is prohibited on or within 1,000 feet of airport property.
- e. Construction suspension may be required during specific airport operations. The Airport Operator will notify the Contractor and Engineer if this is required.
- f. Emergency Aircraft Rescue and Firefighting (ARFF) access in and around the site must be maintained by the Contractor at all times. Any hazards, open trenches, or excavations near the ARFF access must be clearly marked and lighted with red lights during hours of restricted visibility or darkness.

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Memphis International Airport

Your Responsibilities

In the

AIRPORT SECURITY PLAN

MEMPHIS INTERNATIONAL AIRPORT SECURITY RULES AND REQUIREMENTS

It is your responsibility to read, understand and comply with the following security rules and requirements and know the fines and penalties for non-compliance. By requesting and receiving a Memphis International Airport (Airport) ID/Access Badge (Badge), you have agreed to accept significant and important responsibilities and obligations related to the security of the Airport and the use of your Badge. The potential for serious security violations and even great harm exists anytime an individual issued a Badge fails to use the Badge as required or fails to take appropriate action when confronted with a potential security risk or violation.

In the event you commit a security violation, even if it is your first offense, you may have your Badge temporarily suspended or permanently revoked and you may be subject to disciplinary action by your employer, up to and including termination. Bypassing security checkpoint screening to board an airplane as described below, and/or duplicating, reproducing, or altering a Badge, or using a fake Badge, are all examples of security violations that may result in permanent revocation of your Badge.

If you violate a security rule or regulation, you will receive a Notice of Violation (NOV) which will state the location and type of offense committed. A copy of your NOV will be provided to your supervisor. As soon as practical after you are issued a NOV, you will be allowed the opportunity to discuss your NOV with an Airport Police Supervisor, Operations Duty Manager, and, if available, your supervisor. This discussion is your opportunity to present any information which may influence the decision of the Authority to affirm or overturn your NOV.

If your NOV is affirmed, the penalties can range from a written warning up to permanent revocation, depending on the grade of the infraction. Penalty Grades are I, II, and III. The penalties are listed below. In all cases, however, your Badge may be permanently revoked and/or you may be terminated for your first offense, depending upon the particular facts and circumstances surrounding the offense.

If you are unclear about a particular regulation and/or responsibility, it is your obligation to visit the Airport ID Office to get clarification. Failure to understand these rules and requirements will not excuse or lessen the penalties for non-compliance.

A. BADGE USAGE AND ACCESS:

Your Badge is for official use only while on duty at the Airport. You may only use a Badge as specified in these rules and requirements. Any other use of a Badge is strictly prohibited, with the exception of access to your approved employee parking lot.

You may not allow your Badge to be used by another person for any reason, nor may you use another person's Badge under any circumstances. You may not follow another person who is using his or her Badge through an access point into a secure area, and you may not allow someone to follow you through an access point into a secure area. You may not force open a secured door, gate, or entrance instead of using your Badge as required to gain access.

Your Badge must be clearly visible at all times and worn above your waist and below your neck on your outermost garment while in a secure area. Only unexpired Badges are valid and may be used for security purposes. You are responsible for renewing your Badge prior to the date of expiration that is printed on your Badge.

You may not duplicate, reproduce, or alter a Badge or use a fake Badge. Having knowledge of another person engaging in this conduct and not reporting this information to the Airport Police/Communications Center as soon as possible is the same as doing it yourself. This is an especially serious security violation and may result in permanent revocation of your Badge.

You may not use your Badge to gain access to a secure area to board an aircraft. You must submit to screening of your person and baggage at a TSA manned security screening checkpoint in the same manner as any other passenger, unless you are a uniformed airline employee working a flight departing out of Memphis International Airport. Not following this rule is an especially serious security violation and may result in permanent revocation of your Badge.

B. ADDITIONAL AFFIRMATIVE SECURITY DUTIES:

You are responsible for the security of any door, gate or other access point you open until it is completely closed and properly secured, regardless of whether there are security personnel or others near you.

If a door, gate, turnstile, or other security alarm goes off in your presence or where you can hear the alarm, you must respond to the alarm by immediately going to the alarming location and calling Airport Police/Communications Center at (901) 922-8298. You may not leave the area until the alarm is resolved and/or you are instructed to leave by Airport Police.

If you see or know of a person in the restricted area not properly displaying his or her Badge, you are required to request that the person allow you to examine his or her Badge. Check the color, picture, and expiration date of the Badge. If you have any concerns or suspicions, ask the person to remain in your presence while you call the Airport Police/Communications Center for further instruction. Do not attempt to physically restrain the person. Do try to keep the person under visual observation if possible, but only if this can be done safely.

C. ESCORT OF INDIVIDUALS:

For a duty-related need and/or for official business reasons only, individuals with a Badge containing a black box with a green E may escort a person or persons in the secure area only if each escorted person does not have a Badge; has not been denied a Badge; has not had their Badge confiscated or revoked; and is not in the process of obtaining an Airport-issued ID Badge. It is your duty to ask these questions to determine eligibility before escorting any individual without a Badge into a secure area. If you escort one or more individuals, you must remain with the person or persons at all times while in the secure area. Note that you are held completely responsible for the actions of those you escort as well as your own. You can escort as many individuals as you can reasonably control.

D. ESCORT OF VEHICLES:

For a duty-related need and/or for official business reasons only, individuals with a Badge containing a black box with a green E and a Class 2 or 3 driver's license may escort a vehicle and driver in the secure area. The escorted driver must have a valid state driver's license. The escorted vehicle must have current registration and insurance, signs meeting the criteria identified below, and a security cone received from the gate guard.

E. VEHICLE SIGNS:

Vehicles must have signs on both sides of the vehicle at least 12 inches square with letters at least four inches in height. The vehicle must also have a MEM AOA sticker.

F. PENALTIES:

Violation - Grade I (Based on total # of violations within the last 12 months):

- 1st – Written Warning
 - 2nd – 5-Day (120-hour) ID Badge Suspension
 - 3rd – 10-Day ID Badge Suspension
- (Suspension periods begin at the time of the citation.)

Violation - Grade II (According to total # of violations within the last 12 months):

- 1st – 5-Day (120-hour) ID Badge Suspension
 - 2nd – 10-Day ID Badge Suspension
 - 3rd – 30-Day ID Badge Suspension
- (Suspension periods begin at the time of the citation.)

Violation - Grade III:

- Mandatory hearing with the MSCAA Director of Operations and Public Safety
- Minimum: 60-day ID Badge Suspension • Maximum: Permanent ID Badge Revocation

You may reclaim your badge by contacting the Airport Police at (901) 922-8298 and providing a copy of the NOV and proof of required training completion after your badge revocation period has ended.

G. TYPES OF VIOLATIONS:

Grade I shall include but not be limited to:

Safety

- Speeding
- Improper parking
- Not wearing high visibility clothing
- Unsafe operation of vehicle
- Passing aircraft at an unsafe distance
- Failure to properly report fuel/hazmat spill
- Other_____

Security

- Door ajar violation
- Improper display of identification badge
- Improper use of identification badge
- Failure to properly challenge
- Other_____

Grade II shall include but not be limited to:

Safety

- Smoking prohibited violation
- Failure to give way to an aircraft
- Movement area violation (incursion/incident)
- No valid state license/no AOA operators permit
- Other_____ (normally willful or grossly negligent)

Security

- Secure area access violation
- Failure to report an access violation
- Other_____

Grade III shall include but not be limited to:

Security

- Attempt to board an aircraft as a passenger without submitting to TSA screening
- Duplicating, reproducing, or altering a Badge
- Using a fake Badge

H. IMPORTANT PHONE NUMBERS:

Airport Emergencies(901) 922-8333
Airport ID/Access Badge Office(901) 922-8005
Airport Police/Communication Center(901) 922-8298
Airport Security Coordinator(901) 922-8004
Airport Operations(901) 922-8117

ID FM 02a – Airport Security Plan – Your Responsibilities (Revised 09/01/2014)

**ATTACHMENT B: AC 150/5370-2G SAFETY COMPLIANCE DOCUMENT (SPCD)
WORKSHEET FOR AIRPORT PROJECTS**

Contractor's Responsibility

Following Federal Aviation Administration Advisory Circular 150/5370-2G, this SPCD shall be submitted to the Engineer and to the airport operator for review and approval. This should be submitted 14 days prior to the preconstruction conference. The notice-to-proceed cannot be issued without approval of this document.

The SPCD shall be prepared in a detailed, written and pictorial format (if needed) that identifies the timing and methodology for the contractor's compliance with the project's Construction Safety and Phasing Plan (CSPP) located in the construction plans & specifications. Any analysis and determination can be made of the proposed modification.

Project Information

Project ID: _____ Airport: _____
Description of Project: _____
Type of Work: _____
Prime Contractor: _____
Address: _____
Contractor Contact: _____ Phone: _____
BOA Project Manager: _____ Phone: _____
Airport Operations Contact: _____ Phone: _____

The following shall be complement the safety plan compliance document:

1. Contractor shall have copies of the CSPP and SPCD available at all times for reference by the airport operator and its representatives, and by subcontractors and contractor employees.

Location (s) of CSPP and SPCD:

2. Provide a point of contact who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Project will require a 24-hour coverage.

Point of Contact: _____ Phone: _____

3. Contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD whenever active construction is taking place.

Contact Person: _____ Phone: _____
Contact Person: _____ Phone: _____

4. The contractor shall list all proposed deviations or modifications to the CSPP. For each alteration, the contractor shall provide:
- a. The reason why the alteration is desired
 - b. Provide a sufficient narrative description and/or pictorial descriptions of the proposed change so a complete review of the proposal can be made.
 - c. If no alterations are to be made to the CSPP, clearly state; **“No alterations to the CSPP are proposed.”**

The following are proposed deviations or modifications to the CSPP:

(Attach additional sheets as needed)

5. The contractor shall provide a list of the specific hazard equipment and lighting that will be employed to ensure compliance.

The following are proposed hazard equipment and lighting for the project:

(Attach additional sheets as needed)

6. The contractor shall describe the frequency of inspections to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards. Inspections shall ensure that all proper safety devices, signs, demarcations etc. are in place and in proper working order in accordance with the approved CSPP & SPCD. A Construction Project Daily Safety Checklist is attached to aid in making a thorough inspection.

The inspection frequency will be _____.

7. Provide a description and schedule for any anticipated supplemental submittal through the airport operator of Form 7460-1 for the purpose of conducting aeronautical study of contractor, equipment such as tall equipment (cranes, concrete pumps, and other equipment), stock piles, and haul routes when difference from cases previously filed as part of the CSPP.

An additional Form 7460-1 will/will not (circle one) be required. If additional Form 7460-1 will be required, they will be submitted by _____.

8. Provide a description of the contractor's plan to ensure that the construction personnel are familiar with the safety procedures and regulations on the airport, the CSPP, and the SPCD.

(Attach additional sheets as needed)

SPCD Amendment

The SPCD shall be amended anytime there is a construction practice proposed by the contractor that does not conform to the CSPP and SPCD and may impact the airport's operational safety. This will require a revision to the CSPP and SPCD and re-coordination with the airport operation and the FAA in advance.

Certification

I certify that we understand the operational safety requirements of the CSPP and assert that we will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator.

Print Name: _____ Title: _____

Signature: _____ Date: _____

Note to Contractor: Please provide copies of your company's general safety policy as an attachment.

Appendix D. AC 150/5370-2G – December 13, 2017

Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or constructor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriated for each project.

Table D-1. Potentially Hazardous Conditions

Item	Action Required (Describe)	Or	None
Excavation adjacent to runways, taxiways, and apron improperly backfilled.			☐
Mounds of earth, construction materials, temporary structures, and other obstacle near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any signs or marking.			☐
Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.			☐
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.			☐
Equipment or material near NAVAIDS that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.			☐
Tall and especially relatively low visibility units) that is, equipment with slim profiles) – cranes, drills, and similar objects – located in			☐

critical areas, such as OFZ and approach zones.		
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, or any, apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.		☐
Obstacles, loose pavement, trash and other debris on or near AOA. Construction debris (gravel, sand mud, and paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.		☐
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.		☐
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.		☐
Wildlife attractants – such as trash (food scraps not collected from the construction personnel activity), grass seeds, tall grass, or standing water – or any near airports.		☐
Obliterated or faded temporary markings on active operational areas.		☐
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the		☐

approach to any open runway pose aviation hazards.		
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Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction airport conditions.		☐
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway/taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services and/or loss of communications.		☐
Restrictions on ARFF access from fire stations to the runway/taxiway system or airport buildings.		☐
Lack of radio communications with construction vehicles in airport movement areas.		☐
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircrafts operations.		☐
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.		☐

Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.		☐
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Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).		☐
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/works, construction contractors should make provisions for coordinating work on circuits.		☐
Failure to control dust. Consider limiting the amount of area from which contractor is allowed to strip turf.		☐
Exposed wiring that created an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.		☐
Site burning, which can cause possible obscuration.		☐
Construction work taking place outside of designated work areas and out of phase.		☐