

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 Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be either electronic submittals as coordinated with the Engineer or eight (8) hardcopies neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials, or procedures 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 be responsible to maintain a minimum insulation resistance per AC 150/5340-26, Maintenance of Airport Visual Aid Facilities, Table 5-1 and paragraph 5.1.3.1, with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period.

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, nonshielded, with ethylene propylene insulation, cross-linked polyethylene insulation. Conductors for use on 20 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #6 AWG, L-824 Type C, 5,000 volts, nonshielded, with ethylene propylene insulation, 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 Federal Specification J-C-30 and shall be type XHHW-2, 75°C. Conductors for parallel (voltage) circuits shall be sized 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, XHHW-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 XHHW-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 for Internal Safety. The light base ground shall be a #6 AWG (#2 AWG for FAA Facilities) bare copper wire jumper bonded to the ground lug at the light fixture base or stake to a ground rod installed beside the fixture.

108-2.4 Bare copper wire (counterpoise, bare copper wire external ground and ground rods). Wire for counterpoise or external 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 ground wire per ASTM B3 and ASTM B8, and shall be bare copper wire per ASTM B33. See AC 150/5340-30 for additional details about counterpoise and ground wire types and installation. For voltage powered circuits, the equipment ground conductor shall be minimum No. 6 AWG, 600V rated, Type XHHW insulated, green color, stranded copper equipment ground conductor.

Ground rods shall be 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 (2.54 m) long and 3/4 inch (19 mm) in diameter.

108-2.5 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 field-attached plug-in splice. Figure 3 of AC 150/5345-26, Specification for L-823 Plug and Receptacle, Cable Connectors, employing connector kits, is acceptable for field attachment to single conductor cable. It shall be the Contractor's responsibility to determine the outside diameter of the cable to be spliced and to furnish appropriately sized connector kits and/or adapters and heat shrink tubing with integral sealant.

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

c. 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. See AC 150/5340-30 for additional information about methods of attaching a ground to a galvanized light base. All exothermic connections shall be made per the manufacturer's recommendations and listings.

108-2.6 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 Engineer 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.

108-2.7 Concrete. Concrete for cable markers shall be per Specification Item P-610, Structural Portland Cement Concrete.

108-2.8 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.

108-2.9 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.

108-2.10 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 (no known US manufactured equivalent).

108-2.11 Electrical coating. Electrical coating shall be Scotchkote™ as manufactured by 3M™, “LiquidRubber”, or an approved equivalent.

108-2.12 Existing circuits. Whenever the scope of work requires connection to an existing circuit, the circuit’s insulation resistance shall be tested, in the presence of the Engineer. The test shall be performed 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 Engineer. When the work affecting the circuit is complete, the circuit’s insulation resistance shall be checked again, in the presence of the Engineer. The Contractor shall record the results on forms acceptable to the Engineer. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual.

108-2.13 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend magnetic 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.

108-2.14 Bare Copper Wire (Guard Wire). Bare copper wire designated as “Guard Wire” by FAA STD-019 for FAA duct and conduit systems shall conform to ASTM Specifications B3 and B8 and shall be bare copper stranded wire, No. 1/0 AWG.

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. Wherever possible, cable shall be run without splices, from connection to connection.

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 Engineer 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 or at least once in each access point where L-823 connectors are not 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 Engineer.

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 Engineer 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 Engineer prior to any cable installation. If required by the Engineer, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the Engineer. Cable pull tensions shall be recorded by the Contractor and reviewed by the Engineer. 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 Engineer, 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 (46 cm) below finished grade per NEC Table 300.5, except as follows:

- (1) When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches (91 cm) unless otherwise specified.
- (2) Minimum cable depth when crossing under a railroad track, shall be 42 inches (1.07 m) unless otherwise specified.

Dewatering necessary for cable installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay items as part of Item L-108. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-108 Item.

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 mm) sieve. Flowable backfill material may alternatively be used. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Item P-152.

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 Engineer, 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 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 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 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 undisturbed soil, and to the satisfaction of the Engineer. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.) the compaction requirements per Item P-152 for that area shall be followed.

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 Engineer. 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 4-6 inch (100 - 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 inch (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 mulching 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 and compaction shall meet the requirements of Item P-152. 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.

At the location of each underground cable connection, except at lighting units, or isolation transformers, or power adapters shall be marked by a concrete marker slab placed above the connection. 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 Engineer. 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 Engineer. 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. 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. In all cases the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches (38 mm) on each side of the joint.

b. Factory-molded plug-in splices. These shall be made by plugging directly into mating connectors. In all cases, the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches (38 mm) on each side of the joint.

c. 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. Throughout the rest of the splice less tension should be used. 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.

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. As 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 following method of lightning protection shall be installed for the airfield lighting circuit:

a. Isolation – used in areas where lightning strikes are not common. The counterpoise is not bonded to edge light fixtures, in-pavement fixtures shall be bonded to the counterpoise.

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.

For edge light fixtures installed in turf (stabilized soils) and for raceways or cables adjacent to the full strength pavement edge, the counterpoise conductor shall be installed halfway between the pavement edge and the light base, mounting stake, raceway, or cable.

The counterpoise conductor shall be installed 8 inches (203 mm) minimum below grade.

Each light base or mounting stake shall be provided with a grounding electrode.

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

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

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.

If shown on the plans or in the specifications, a separate equipment (safety) ground system shall be provided in addition to the counterpoise wire using one of the following methods:

- a. ground rod installed at and securely attached to each light fixture base, mounting stake, and to all metal surfaces at junction/access structures via #6 AWG wire.

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.

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 cone of protection measured 22-1/2 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 Bare Wire Installation for Light Base Ground. As shown on the details or included in the job specifications, a copper grounding wire shall be installed for safety (personnel protection) per paragraph 12.6 of AC-150-5340-30 (Latest Edition), "Design and Installation Details for Airport Visual Aids". The safety ground shall be connected to the external ground lug on the fixture base and to a ground rod installed beside the fixture. The resistance to ground of the base must be 25 ohms or less per measurement with a ground tester. See the NEC Handbook for additional information about grounding electrode installation and testing. **The light base ground shall be incidental to the installation of each base, light or sign.**

108-3.10 Insulated Wire Installation for Light Fixture Bonding. As shown on the details or included in the job specifications, a copper grounding wire shall be installed for safety (personnel protection) per paragraph 12.7 of AC-150-5340-30 (Latest Edition), "Design and Installation Details for Airport Visual Aids". The safety ground shall be connected to the ground lug on the fixture base plate or fixture to the internal ground lug on the base can. **The light fixture bond shall be incidental to the installation of each base, light or sign.**

108-3.11 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the Engineer, 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 also 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 "LiquidRubber", or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.12 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 Engineer. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the Engineer. 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 Engineer for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the Engineer. 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 Engineer 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 Engineer the following:

- a. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.
- b. That all affected circuits (existing and new) are free from unspecified grounds.
- c. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than 100 megohms.
- d. 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.
- e. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.
- f. 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.

g. 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 Engineer prior to performing the testing.

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

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

METHOD OF MEASUREMENT

108-4.1 The Contract Linear Foot Price paid for L-824, Type C, 1/C #8, 5 kV Cable shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved for installing Cable in duct bank or conduit and tested, complete in place, including layout, debris control and cleanup, as shown on the Drawings and as specified in this Item. The measurement for this item shall include additional quantities required for slack.

108-4.2 The Contract Linear Foot Price paid for L-824, Type C, 1/C #6, 5 kV Cable shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved for installing Cable in duct bank or conduit and tested, complete in place, including layout, debris control and cleanup, as shown on the Drawings and as specified in this Item. The measurement for this item shall include additional quantities required for slack.

108-4.3 The Contract Linear Foot Price paid for Bare, 1/C #6, Counterpoise Wire shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved for installing Counterpoise Wire including ground rods and grounding connectors complete in place and tested, including layout, dust and debris control and cleanup, as shown on the Drawings and as specified in this Item. The measurement for this item shall include additional quantities required for slack.

BASIS OF PAYMENT

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

Payment will be made under:

| | |
|----------------|--|
| Item L-108-5.1 | L-824, Type C, 1/C #8, 5 kV Cable - per liner foot |
| Item L-108-5.2 | L-824, Type C, 1/C #6, 5 kV Cable - per liner foot |
| Item L-108-5.3 | Bare, 1/C #6, Counterpoise Wire - per linear foot |

MATERIAL REQUIREMENTS (ALL REFERENCES ARE CURRENT EDITION.)

| | |
|---------------------------------------|--|
| 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-59544 | Cable and Wire, Electrical (Power, Fixed Installation) |
| Commercial Item Description A-A-55809 | Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic |
| ASTM B 3 | 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 D 4388 | Rubber tapes, Nonmetallic Semiconducting and Electrically Insulating |
| FED SPEC J-C-30 | Cable and Wire, Electrical (Power, Fixed Installation) |
| MIL-I-24391 | Insulation Tape, Electrical, Plastic, Pressure Sensitive |

REFERENCE DOCUMENTS (ALL REFERENCES ARE CURRENT EDITION.)

| | |
|------------------|---|
| NFPA-70 | National Electric Code |
| NFPA-780 | Standard for the Installation of Lightning Protection Systems |
| MIL-S-23586F | Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical |
| ANSI/IEEE STD 81 | IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System |

END OF ITEM L-108

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ITEM L-110 AIRPORT UNDERGROUND ELECTRICAL DUCT BANKS AND CONDUITS

DESCRIPTION

110-1.1 Scope. 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 trenching, backfilling, removal and restoration of any paved areas, restoration of turfed or seeded (mulched) 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.

110-1.2 Shop Drawings and Material Lists. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. PVC Conduit, fitting and cement.
- b. HDPV Conduit, boring installation procedure and welding procedure details.
- c. Conduit rack system with installation details.

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 Engineer.
- b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not comply with these specifications shall be removed, 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 Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify 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 Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be either electronic submittals as coordinated with the Engineer or eight (8) hardcopies neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures 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 mil 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.

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 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 conform to Item P-610, Structural Portland Cement Concrete, using 3/4 inch maximum size coarse aggregate with a minimum 28-day compressive strength of 4,000 psi. Where reinforced duct banks are specified, reinforcing steel shall conform to ASTM A615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

110-2.7 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. Fill shall be designed to achieve a 28-day compressive strength of 200 psi under pavement.

110-2.8 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) 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.

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The Engineer 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. No duct bank or underground conduit shall be less than 18 inches (0.5 m) below finished grade. Where under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade.

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 Engineer 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 mm) sieve. Flowable backfill may alternatively be used. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Item P-152.

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 Engineer. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (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 Engineer, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Alternatively, additional duct bank supports that are adequate and stable shall be installed, as approved by the Engineer.

All excavation shall be unclassified and shall be considered incidental to the respective L-110 pay item of which it is a component part. Dewatering necessary for duct installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay item as a part of Item L-110. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-110 Item.

Unless otherwise specified, excavated materials that are deemed by the Engineer 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 Engineer 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 Engineer, 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 inch (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 Engineer 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 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 Engineer 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 Engineer.

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 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 Engineer 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 Engineer, 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 Engineer. 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 Engineer. 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 or ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 “Excavation and Embankment” except that material used for back fill shall be select material not larger than 4 inches (100 mm) in diameter.

Flowable (P-153) backfill may alternatively be used in lieu of the P-152 to within 12-inches of finished grade. P-152 shall be used to fill to finished grade.

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 Engineer.

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 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 (P-153) backfill may alternatively be used in lieu of the P-152 to within 12-inches of finished grade. P-152 shall be used to fill to finished grade.

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 Engineer.

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

METHOD OF MEASUREMENT

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

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item per the provisions and intent of the plans and specifications.

Payment will be made under:

| | |
|----------------|--|
| Item L-110-5.1 | Single-way 2" Conduit, Direct Buried - per linear foot |
| Item L-110-5.2 | Multiple-way (6) 2-inch Conduits, Direct Buried - per linear foot |
| Item L-110-5.3 | Multiple-way (8) 2-inch Conduits, Direct Buried - per linear foot |
| Item L-110-5.4 | Single-way 2" Conduit, Concrete Encased - per linear foot |
| Item L-110-5.5 | Multiple-way (4) 2-inch HDPE Conduits, Directional Bored - per linear foot |
| Item L-110-5.6 | Multiple-way (6) 2-inch HDPE Conduits, Directional Bored - per linear foot |
| Item L-110-5.7 | Multiple-way (8) 2-inch HDPE Conduits, Directional Bored - per linear foot |
| Item L-110-5.8 | System Drain, (1) 2" Conduit, Concrete Encased – per LF |

MATERIAL REQUIREMENTS (ALL REFERENCES ARE CURRENT EDITION.)

| | |
|---|--|
| AC 150/5340-30 | Design and Installation Details for Airport Visual Aids |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |
| ASTM A615 | Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| 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 (2,700 kN-m/m ³)) |
| ASTM D2167 | Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| ASTM D2922 | Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| NFPA-70 | National Electrical Code (NEC) |
| Underwriters Laboratories Standard 6 | Electrical Rigid Metal Conduit - Steel |
| Underwriters Laboratories Standard 514B | Conduit, Tubing, and Cable Fittings |
| Underwriters Laboratories Standard 514C | Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers |
| Underwriters Laboratories Standard 1242 | Electrical Intermediate Metal Conduit Steel |
| Underwriters Laboratories Standard 651 | Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings |
| Underwriters Laboratories Standard 651A | Type EB and A Rigid PVC Conduit and HDPE Conduit |

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ITEM L-111 ENGINE GENERATOR AND ACCESSORIES

DESCRIPTION

111-1.1 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions, apply to work specified in this Item.

111-1.2 SCOPE. This Item includes all the labor, equipment and material necessary to provide and install a new engine generator and accessories.

111-1.3 APPLICABLE DOCUMENTS. The publications listed at the end of this Item are incorporated herein by reference and form a part of this Item to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of this solicitation shall be applicable. In the text of this Item, such publications are referred to by basic designation only. Additional details and specifications pertaining to a specific system are contained in these documents and are to be considered as part of this Item. Perform all work in accordance with these documents except as specified herein. In the event of a conflict between contract documents and the referenced documents, the more stringent rule shall be applied.

111-1.4 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. Engine generator with exhaust system and residential level muffler,
- b. Batteries,
- c. Block heater and controls.

EQUIPMENT AND MATERIALS

111-2.1 ENGINE GENERATOR SET. The Contractor shall furnish and install a complete diesel engine-driven generator set with associated controls as specified herein and as shown in the plans. The unit shall consist of a radiator-type, water-cooled engine directly connected to a generator and mounted with vibration isolators on a heavy-duty steel base and shall include all necessary engine and generator controls required to provide electrical output as specified herein and on the plans. All materials shall be new and of current manufacture, free from defects and covered by manufacturer's two-year warranty, which must include parts and labor.

The complete generating unit shall be factory furnished ready for operation as soon as the required connections have been made to the unit's power and control wiring systems and fueling system. The standby generator set shall be supplied to operate on #2 diesel fuel. The engine shall be liquid-cooled by means of a radiator with an engine-driven fan. The standby generator set shall be rated Continuous Standby (defined as continuous for the duration of any power outage), 480/277 volts, 3-phase, 4-wire, 0.8 power factor, standby rated at 250 kW, at 1000 ft MSL, 110°F ambient.

a. Engine.

(1) Manufacturers:

(a) Caterpillar

(b) Cummins.

(c) Substitutions: L-100, Paragraph 1.5 – Shop Drawings and Material Lists.

(2) The turbo-charged and after-cooled engine shall be compression ignition Diesel internal combustion engine, in-line or V-type 6 cylinder, liquid cooled, with not less than 540 cubic inch displacement. Four cycle engines only will be considered. Engine shall be Tier 3 certified.

(3) Engine speed shall be governed to maintain generator frequency at 60 Hz + 3 Hz from No Load to Full Load generator output.

(4) Engine shall be equipped with the following:

(a) 12 or 24 volt positive engagement solenoid shift starting motor.

(b) 12 or 24 volt batteries.

(c) 2.5 kW block heater.

(d) Lube oil filter - dry-type air cleaner - fuel filter.

(e) Electric solenoid fuel shutoff valve.

(f) Gas-proof, seamless, stainless steel, flexible exhaust connection, exhaust sound attenuator.

(g) Flexible fuel connection - oil drain extension.

(h) Radiator duct flange.

b. Generator. The generator shall be a brushless, 12-lead re-connectable, of drip proof construction with amortisseur windings. Insulation shall be Class F with epoxy varnish. Generator field current shall be controlled by a rotating thyristor bridge module, optically coupled to a firing circuit type voltage regulator. The exciter shall be permanent magnet rotating type. Generators controlled by wound field exciters will not be accepted unless they meet the following performance:

(1) Radio-interference suppression meeting commercial standards shall be supplied.

(2) If a line-to-neutral short circuit occurs, the generator shall support 300 percent rated current for 10 seconds without externally mounted devices.

(3) A re-settable line current-sensing circuit breaker with inverse time versus current responses shall be furnished which protects the generator from damage due to overload. This breaker shall not trip within the 10 seconds specified above. It shall be rated 400 amps.

c. Controller. Controller shall be vibration isolated on the generator enclosure. It shall be of solid-state design. Relays will be acceptable only for high current circuits. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:

- (1) Fused DC circuits.
- (2) Complete 2-wire START/STOP control which shall operate on activation of a remote contact.
- (3) Cranking period controlled by a speed sensor which disengages the starting motor when the engine has started. Battery charging alternator or generator voltage may not be used for this signal.
- (4) The starting system shall be designed for restarting in the event of a false engine start by permitting the engine to completely stop and then re-engage the starter.
- (5) Cranking cycle with individually adjustable (2 to 20 seconds) ON and OFF cranking periods.
- (6) Overcranking protection designed to open the cranking circuit after 60 seconds if the engine fails to start.
- (7) Circuitry, with reset button, to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed is received.
- (8) Adjustable (2- to 10-minute), factory set at 5-minute, time delay to permit unloaded running of the standby set after transfer of the load to normal.
- (9) Alarm horn to sound alarm when engine shuts down due to high coolant temperature, low oil pressure, overspeed, or low fuel.
- (10) Three-position (AUTOMATIC-OFF-TEST) selector switch.
- (11) Standby stop switch.
- (12) Remote fault signal dry contact relay package.
- (13) Indicating lights to signal:
 - (a) Switch "OFF"--(flashing red)
 - (b) Overcrank--(red)
 - (c) Standby Stop--(red)
 - (d) High Coolant Temperature--(red)
 - (e) Overspeed--(red)
 - (f) Low Oil Pressure--(red)

- (g) Low Fuel--(red)
- (14) Test button for indicating lights.
- (15) Connections to the controller shall be by plug-in wiring harnesses.
- d. **Instrument Panel.** A set-mounted instrument panel shall include:
 - (1) Dual-range voltmeter, 2 percent accuracy.
 - (2) Dual-range ammeter, 2 percent accuracy.
 - (3) Voltmeter-ammeter phase selector switch.
 - (4) Frequency meter,.3 Hz accuracy.
 - (5) Battery-charging ammeter.
 - (6) Oil pressure gauge.
 - (7) Coolant temperature gauge.
 - (8) Running time meter.
 - (9) Voltage regulator with front panel voltage adjusting rheostat.
 - (10) Fuel level gauge.
- e. **Generator Set Mounting.** The standby generator set shall be equipped with factory-installed vibration isolators mounted between the set and fabricated steel base to prevent distortion of alignment between generator and engine when installed.
- f. **Operating Characteristics.** Shall be within the following parameters:
 - (1) **Frequency (Speed Control).**
 - (a) Regulation, +3 Hz from No-Load to Full-Load.
 - (b) Stability, steady-state governing speed band, ± 0.25 percent of governed speed.
 - (c) Transient Response Characteristics, maximum deviation from steady-state band, ± 3.0 percent for any 25 percent of rated load change with recovery to steady-state speed band within three (3) seconds after excursion for same.
 - (2) **Voltage Output.**
 - (a) **Regulation.** ± 2 percent of rated voltage from No-Load to Full-Load.
 - (b) **Stability (Modulation).** ± 5 percent of rated voltage.
 - (c) **Voltage Adjustment Range.** ± 5 percent of rated voltage.

(d) **Transient Response Characteristics.** For any 25 percent of rated load change at 0.8 PF, the maximum voltage excursion shall not exceed 5 percent from rated with recovery to stable band within 0.25 seconds, or maximum dip 20 percent with recovery in two (2) seconds when 100 percent load is applied.

g. **Accessories.** The following shall be factory installed by the Manufacturer:

(1) Exhaust silencer to attenuate exhaust noise to critical residential degree

(2) Flanged exhaust connection with convoluted or bellows-type stainless steel flexible section (to relieve engine exhaust outlet from piping stress.)

(3) Starting battery, heavy-duty lead acid, 12 or 24 V system, capable of 180 seconds of sustained cranking in an ambient temperature of 0°F, complete with required tray jumpers, intercell connectors and two (2) 6-foot 4/0 copper battery cables with lugs.

h. **Engine Block Heater.** 2.5 kW, 120 V ac minimum.

(1) Ethylene glycol antifreeze solution in cooling system to protect to temperatures of 0°F.

(2) Six (6) sets of maintenance and operating instructions, wiring diagrams and parts lists.

111-2.2 POWER CIRCUITS FOR ACCESSORIES. Reconnect existing branch circuits from facility power panel for battery charger, fuel pump and engine block heater.

111-2.3 GUARANTEE. The engine generator and associated equipment shall be unconditionally guaranteed against any defects for a period of two (2) years.

INSTALLATION OF GENERATOR SET AND ACCESSORIES

111-3.1 GENERAL. The Contractor shall furnish, install and connect all equipment, equipment accessories, conduit, cables, wires, busses, grounds, pipes, pumps and controls necessary to ensure a complete and operable motor generator installation as specified herein and shown on the plans.

A new emergency engine generator power supply and new exhaust system shall be furnished and installed.

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

111-3.2 GENERATOR SET OPERATIONAL TESTS. The Contractor shall provide allowance for factory-authorized test runs of the generator after installation. The Contractor shall connect the engine **generator** set, ready to operate, fill the crank case with the correct grade of oil, fill the cooling system, and notify the Owner when the set is ready **for operation**.

a. The Contractor shall run the generator. When it is ready for operation and testing, the Owner shall be notified in writing 48 hours in advance of and shall witness tests. Operational tests will require 4 hours of operation. These tests shall include, may not be limited to, the following:

- (1) With commercial power applied to the power plant entrance switch and the engine generator set in STANDBY mode (i.e., engine generator transfer switch in NORMAL), the set shall be started by actuating the NO LOAD test device and the set placed under load by applying the system load, or the load bank equivalent to the system load, to the load side of the transfer switch. The service entrance switch shall then be opened to simulate a commercial power failure. After the engine-generator set has started and transferred to the STANDBY mode, the system shall be checked to ensure that the resistive load bank has been automatically disconnected from the systems by the load bank contactor device (LC) and the engine-generator transfer switch has transferred to the GENERATOR (EMERGENCY) position. The resistive load bank application device shall then be actuated to ensure that the load bank cannot be applied to the set while the system is in this mode. The set shall then be shut down (after 15 minutes approximately).
- (2) With the engine generator set transfer switch in NORMAL (COMMERCIAL) position and commercial power applied to the power plant entrance switch, the engine generator set shall be restarted on NO LOAD test and the system load, or load bank equivalent to system load, applied to the load side of the transfer switch. All electrical and mechanical subsystems, lights, fans and other electrical equipment shall be functionally tested.
- (3) At least one-half hour of the test shall be run at each 50 percent load and full load with appropriate load bank furnished by the Contractor.

111-3.3 FUEL OIL SYSTEM.

- a. **Fuel Piping System Connections.** Install new piping connections between the engine and points of connection with the existing diesel fuel system supply and return.
- b. **Piping and Unions.** All piping shall be reamed at ends and thoroughly cleaned before installing. All screwed joints in piping shall be made up with litharge and glycerine. All unions shall be of an approved type, having at least one face of the joint, eliminating the use of packing or gaskets.

METHOD OF MEASUREMENT

111-4.1 ENGINE GENERATOR SETS. This Item consists of the new engine generator set including controls, exhaust system and accessories, furnished, shipped, installed and accepted as a complete unit.

111-4.2 ENGINE GENERATOR REMOVAL. This Item consists of the removal and disposal of the existing engine generator set including controls, exhaust system and accessories.

111-4.3 FURNISH TEMPORARY GENERATOR FOR USE DURING WEST ALV ENGINE GENERATOR REPLACEMENT. This Item consists of all labor and materials required to provide a temporary 250kW generator for transition periods during engine generator replacement as shown on the plans and as described in this. Also included in this item are all electrical connections, testing, continued fueling and maintaining of the generator as required to make the temporary generator 100% operational for the duration of the planned engine generator replacement.

BASIS OF PAYMENT

111-5.1 ENGINE GENERATOR SET. Payment will be made at the contract Lump Sum price for the installed engine generator set and all appurtenances in this Item. This price shall be full compensation for all labor, equipment, tools and incidentals necessary to complete the item. The unit price of this item shall also include the Contractor's overhead, profit and markup.

111-5.2 ENGINE GENERATOR REMOVAL. Payment will be made at the contract Lump Sum price for the removal and disposal of the existing engine generator set and indicated appurtenances in this Item. This price shall be full compensation for all labor, equipment, tools and incidentals necessary to complete the item. The unit price of this item shall also include the Contractor's overhead, profit and markup.

111-5.3 FURNISH TEMPORARY GENERATOR FOR USE DURING WEST ALV ENGINE GENERATOR REPLACEMENT. Payment will be made at the contract per Week (WK) price for the installation, connection and removal of a temporary engine generator set. This price shall be full compensation for all labor, equipment, tools and incidentals necessary to complete the item. The unit price of this item shall also include the Contractor's overhead, profit and markup.

Payment will be made under:

| | |
|----------------|---|
| Item L-111-5.1 | Furnish and Install Packaged 480/277 Volt Engine Generator, Controls and Exhaust System for West ALV – per Lump Sum |
| Item L-111-5.2 | Remove and Dispose of Existing 480V West ALV Engine Generator, Controls and Exhaust System – per Lump Sum |
| Item L-111-5.3 | Furnish Temporary Engine Generator – per Week |

REFERENCE PUBLICATIONS

111-6.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATION REFERENCED IN ITEM L-111.

ASTM A53-89 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM B88-89 Seamless Copper Water Tube

111-6.2 FEDERAL AVIATION ADMINISTRATION (FAA) SPECIFICATION REFERENCED IN ITEM L-111.

FAA-C-1217f Electrical Work, Interior

111-6.3 NATIONAL FIRE PROTECTION ASSOCIATION, INC. (NFPA) SPECIFICATIONS REFERENCED IN ITEM L-111.

NFPA 30-87 Flammable and Combustible Liquids Code

NFPA 31-87 Installation of Oil Burning Equipment

NFPA 70-96 National Electrical Code (NEC)

111-6.4 UNDERWRITERS' LABORATORIES, INC. (UL) SPECIFICATIONS REFERENCED IN ITEM L-111.

UL 1008 Transfer Switch Equipment

111-6.5 NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION:

NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).

NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches.

NEMA ICS 10 Industrial Control and Systems: AC Transfer Switch Equipment.

NEMA MG 1 Motors and Generators.

111-6.6 INTERNATIONAL ELECTRICAL TESTING ASSOCIATION:

NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

111-6.7 NATIONAL FIRE PROTECTION ASSOCIATION:

NFPA 30 Flammable and Combustible Liquids Code.

NFPA 99 Standard for Health Care Facilities.

NFPA 110 Standard for Emergency and Standby Power Systems.

END OF ITEM L-111

ITEM L-115 ELECTRICAL MANHOLES AND JUNCTION STRUCTURES

DESCRIPTION

115-1.1 Scope. 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 Engineer. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the Engineer.

115-1.2 Shop Drawings and Material Lists. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. Dimensioned, detailed shop drawings.
- b. Appurtenances: Hinged cover and frame, pulling irons, inserts, construction channel, cable racks, etc.
- c. Structural engineering calculation, signed and sealed by a register PE of the State of Texas.
- d. Installation details.

EQUIPMENT AND MATERIALS

115-2.1 General.

- a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.
- b. Manufacturer's certifications shall not relieve the Contractor of the 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 Engineer) 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 Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify 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 Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be either electronic submittals as coordinated with the Engineer or eight (8) hardcopies neatly bound in a properly sized 3-ring binder,

tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures 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. Replacement equipment for the equipment that fails within the guarantee period shall be provided with an extended five (5) year warranty from the date of replacement.

115-2.2 Concrete structures. Pre-cast concrete structures shall be per the details and dimensions shown on the plans.

Provide precast concrete structures where shown on the plans. Precast concrete structures shall be an approved standard design of the manufacturer. Precast units shall have mortar or bitumastic sealer placed between all joints to make them watertight. The structure shall be designed to withstand 150,000 lb 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, not drilled. Expansion anchors are not acceptable.

Signed and sealed shop drawings, design calculations, and other information requested by the Engineer shall be submitted by the Contractor to allow for a full evaluation by the Engineer. The Engineer shall review per the process defined in the General Provisions.

115-2.3 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 galvanized steel blank cover, gasket, and stainless steel or coated steel hardware per FAA Engineering Brief (EB) #83. Covers shall be 3/8-inch (9-mm) thickness for L-867 and 3/4-inch (19-mm) thickness for L-868.

115-2.4 Mortar. The mortar shall be composed of one part of Portland cement and two parts of mortar sand, by volume. The Portland 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 C6. Water shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

115-2.5 Concrete. All concrete used in structures shall conform to the requirements of Item P-610, Structural Portland Cement Concrete.

115-2.6 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

All castings specified shall withstand a maximum tire pressure of 250 psi and maximum wheel load of 150,000 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.

115-2.7 Reinforcing steel. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A615, Grade 60.

115-2.8 Bedding/special backfill. Bedding or special backfill shall be as shown on the plans.

115-2.9 Flowable backfill. Flowable material used to backfill shall conform to the requirements of Item P-153, Controlled Low Strength Material.

115-2.10 Cable trays. Cable trays, if specified, shall be of galvanized steel, plastic, or aluminum. Cable trays shall be configured and located as shown on the plans.

115-2.11 Plastic conduit. Plastic conduit shall comply with Item L-110, Airport Underground Electrical Duct Banks and Conduits.

115-2.12 Conduit terminators. Conduit terminators shall be pre-manufactured for the specific purpose and sized as required or as shown on the plans.

115-2.13 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.

115-2.14 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.

115-2.15 Construction Channel Embedments. Handholes shall be fitted on each wall with two 24-inch galvanized inserts for cable racks (Unistrut P-3000, Cooper B-Line B32GALV10 or equal). Each rack shall be provided with a minimum of two saddle rack type arms with two saddles. Rack arms shall be made of galvanized steel or of non-flammable polymer as manufactured by Underground Devices, Inc., Hubbell Power Systems, or equal, or as detailed on the drawings.

CONSTRUCTION METHODS

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

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.

All excavation shall be unclassified and shall be considered incidental to the respective L-115 pay item of which it is a component part. Dewatering necessary for L-115 structure installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay item as a part of Item L-115. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-115 Item.

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

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

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

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

Prior to installation the Contractor shall provide a minimum of 12 inches (150 mm) of sand or a material approved by the Engineer as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

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

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

115-3.4 Placement and treatment of castings, frames and fittings. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer and shall be

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

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

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

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

115-3.5 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 Engineer may order the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

115-3.6 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 Engineer.

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

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

115-3.7 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.

115-3.8 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.

115-3.9 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.

115-3.10 Restoration. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective L-115 pay item.

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

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

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.

115-3.11 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.

115-3.12 Manhole elevation adjustments. The Contractor shall adjust the tops of existing manholes in areas designated in the Contract Documents to the new elevations shown. The Contractor shall be responsible for determining the exact height adjustment required to raise the top of each manhole to the new elevations. The existing top elevation of each manhole to be adjusted shall be determined in the field and subtracted/added from the proposed top elevation.

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

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

115-3.13 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 Electrical structures and junction structures shall be measured by each unit completed in place and accepted. The following additional work items are specifically included in each unit:

- All Required Excavation, Dewatering
- Sheeting and Bracing
- All Required Backfilling with On-Site Materials
- Restoration of All Surfaces and Finished Grading, Sodding
- All Required Connections
- Dewatering If Required
- Temporary Cables and Connections
- Ground Rod Testing

115-4.2 Electrical Structure elevation adjustments shall be measured by the completed unit installed, in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

BASIS OF PAYMENT

115-5.1 The accepted quantity of electrical structures and junction structures will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

115-5.2 Payment shall be made at the contract unit price for electrical structure elevation adjustments. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary, including but not limited to, spacers, concrete, rebar, dewatering, excavating, backfill, topsoil, sodding and pavement restoration, where required, to complete this item as shown in the plans and to the satisfaction of the Engineer.

Payment will be made under:

| | |
|----------------|---|
| Item L-115-5.1 | New Concrete Handhole, Type I, Furnished & Installed - Per Each |
| Item L-115-5.2 | Extend Handhole To New Grade - Per Each |
| Item L-115-5.3 | Two-Can Junction Can Plaza, Furnished & Installed - Per Each |
| Item L-115-5.4 | Extend Two-Can Junction Can Plaza To New Grade - Per Each |

MATERIAL REQUIREMENTS (ALL REFERENCES ARE CURRENT EDITION.)

| | |
|---------------------------------------|---|
| ANSI/IEEE Std 81 | IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System |
| AC 150/5345-7 | Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits |
| AC 150/5345-26 | Specification for L-823 Plug and Receptacle Cable Connectors |
| 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 A-A 59544 | |
| | Cable and Wire, Electrical (Power, Fixed Installation) |
| 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 EB #83 | In Pavement Light Fixture Bolts |
| MIL-P-21035 | Paint High Zinc Dust Content, Galvanizing Repair |
| NFPA-70 | National Electrical Code (NEC) |

END OF ITEM L-115

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ITEM L-850 RUNWAY IN-PAVEMENT LIGHTS

DESCRIPTION

850-1.1 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions apply to work specified in this Item.

850-1.2 SCOPE. This Item shall consist of installing new or reinstalling existing in-pavement, runway edge lights in accordance with these specifications and at the locations shown on the Plans and light fixture schedule.

This Item involves the following work in accordance with these specifications and at the locations shown on the Plans and light fixture schedule:

L-850A.

- a. Install New L-850A Runway Centerline Light fixtures.
- b. Install new isolation transformers in new circuit.
- c. Testing fixtures per Item L-100. Photometric Testing shall be under L-100a.

L-850B.

- a. Salvage and Re-install Existing L-850B Runway Touchdown Zone Light fixtures.
- b. Install new isolation transformers in new circuit.
- c. Testing fixtures per Item L-100. Photometric Testing shall be under L-100a.

L-850C

- a. Salvage and Re-install Existing L-850C Runway Edge Light fixtures with appropriate colored lens on new and existing light bases.
- b. Install new isolation transformers in new circuit.
- c. Testing fixtures per Item L-100. Photometric Testing shall be under L-100a.

850-1.3 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. L-850A, (centerline), Style 3 light fixture.
- b. L-830 Isolation transformer.
- c. Bolts and hardware.
- d. Installation tools and details.

850-1.4 LOCATION/ELEVATION. Lights shall be spaced on centers as indicated on the Plans. Centerline lights shall be located 2'-6" (+0", -6") from runway centerline to center of fixture. Longitudinal tolerance is as indicated on the pavement coordination drawings.

Elevation of in-pavement bases shall be set so that, including extension rings, the light fixture flange shall be within +0/-1/8-inch of the finished pavement surface.

850-1.5 IDENTIFICATION NUMBERS. Identification numbers are provided in data tables on the plans for construction purposes.

850-1.6 AIMING.

- a. L-850A, Centerline. The axis of the fixture through the light beam shall be parallel to the centerline of the runway.
- b. L-850B, TDZ. The axis of the fixture shall be parallel to the centerline of the runway. The indicator arrow on the top of the fixture shall point toward the runway centerline. Verify correct locations for left and right side fixtures.
- c. L-850C, Edge. The axis of the fixture through the light beam shall be parallel to the centerline of the runway. The indicator arrow on the top of the fixture shall point toward the runway.

850-1.7 LIGHT BASE AND LIGHT INSTALLATION ALIGNMENT TOOL. See Item L-867/868

850-1.8 TESTING. Refer to Item L-100, Paragraph 100-3.8 for tests of applicable equipment.

MATERIALS

850-2.1 GENERAL.

- a. Airport lighting equipment and materials covered by advisory circulars (ACs) must be certified and listed in AC 150/5345-53, Airport Lighting Equipment Certification Program, current edition and addendum.
- b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.
- c. All equipment and materials furnished and installed in 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. Replacement equipment for the equipment that fails within the guarantee period shall be provided with an extended five (5) year warranty from the date of replacement.

850-2.2 FLUSH IN-PAVEMENT RUNWAY LIGHT FIXTURES. Fixtures shall meet the requirements of FAA AC 150/5345-46, be suitable for use with a 20 amp primary/6.6 amp secondary circuits and mount on a 12-inch diameter (Size B) L-868 base can. The reveal above the adjacent pavement surface shall not exceed 0.25-inch. Provide with grounding lug (see Plans). All Lamps shall be 6.6 amp quartz type. Fixture shall be of the following configurations:

- a. L-850A, (two cord set, two 48 watt lamps with white or red optical system as indicated on the plans).
- b. L-850B (Existing, with white optical system).

- c. L-850C (two 105 watt lamps with white or amber optical system as indicated on the plans).

850-2.3 LIGHT BASE. See Item L-867/868. Size B, 24-inch-deep, one or two-piece, with appurtenances, meeting the requirements of FAA AC 150/5345-42, current edition.

850-2.4 RUNWAY IN-PAVEMENT LIGHT ISOLATION TRANSFORMER. Type L-830, 20A/6.6A, 60 hertz, of the appropriate wattage for the type of associated fixtures per manufacturer's recommendation, meeting the requirements of FAA AC 150/5345-47, current edition.

850-2.5 HARDWARE. All bolts shall be Type 410 stainless steel. Install using marine grade anti-seize compound. All nuts, washers and lockwashers shall be Type 18-8 stainless steel. Lockwashers shall be 2-piece anti-vibration lock washers.

850-2.6 CABLE. See Item L-108. Type L-824C, 5 kV, and 600 V, meeting the requirements of FAA AC 150/5345-7, current edition. The 600V cable for the secondary between the in-pavement fixture and isolation transformer shall be incidental to, and integral with, the L-830 isolation transformer.

850-2.7 PLUG AND RECEPTACLE CABLE CONNECTORS. Type I, Class A, meeting the requirements of FAA AC 150/5345-26, current edition.

850-2.8 CONCRETE. Concrete for backfill shall conform to the requirements of Item P-610, *Structural Portland Cement Concrete* (4,000 psi).

850-2.9 GROUT AND SEALANT. See Item L-867/868.

METHOD OF MEASUREMENT

850-3.1 NEW FLUSH RUNWAY CENTERLINE LIGHTS. The quantity to be measured shall be for the installation of each new flush in-pavement runway centerline fixture with appurtenances (new isolation transformers (2 per fixture) with secondary cable assemblies), on a modified existing base (under Item L-867/868: including light base, flange ring, spacer, and counterpoise loop and ground rod). Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

850-3.2 SALVAGE AND REINSTALL FLUSH RUNWAY TDZ LIGHTS. The quantity to be measured shall be for the salvage and re-installation of each existing flush in-pavement runway touchdown zone fixture with appurtenances (new isolation transformer with secondary cable assembly), on a modified existing base. Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

850-3.3 SALVAGE AND REINSTALL FLUSH RUNWAY EDGE LIGHTS. The quantity to be measured shall be for the salvage and re-installation of each existing flush in-pavement runway edge fixture with appurtenances (new isolation transformer with secondary cable assembly), on a modified existing base or on a new base (under Item L-867/868: including light base, flange ring, spacer, and counterpoise loop and ground rod). Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

BASIS OF PAYMENT

850-4.1 NEW FLUSH RUNWAY CENTERLINE LIGHTS. Payment for the installation of new flush runway centerline lights shall be made at the contract unit price for furnishing and installing said

lights. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item. Payment for modifying the L-868 base shall be paid under Item L-867/868.

850-4.2 SALVAGE AND REINSTALL FLUSH RUNWAY TDZ LIGHTS. Payment for the salvage and re-installation of existing flush runway touchdown zone lights shall be made at the contract unit price for salvaging and re-installing said lights. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item. Payment for modified L-868 base shall be paid under Item L-867/868.

850-4.3 SALVAGE AND REINSTALL FLUSH RUNWAY EDGE LIGHTS. Payment for the salvage and re-installation of existing flush runway edge lights shall be made at the contract unit price for installing said lights. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item. Payment for furnishing and installing the L-868 base shall be paid under Item L-867/868.

Payment will be made under:

| | |
|----------------|---|
| Item L-850-4.1 | New In-pavement L-850A Runway Centerline Light with New Isolation Transformers on Existing or Modified Base – per Each |
| Item L-850-4.2 | Salvage and Reinstall In-pavement L-850B Runway TDZ Light with New Isolation Transformer on Existing Base – per Each |
| Item L-850-4.3 | Salvage and Reinstall In-Pavement L-850C, Runway Edge Light with New Isolation Transformer on New or Existing Base – per Each |

REFERENCED PUBLICATIONS

850-5.1 FAA SPECIFICATIONS REFERENCED IN L-850. All references shall be current edition.

| | |
|----------------|---|
| 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 150/5345-42 | Specification for Airport Light Bases, Transformer Housings, Junction Boxes and Accessories |
| AC 150/5345-46 | Specification for Runway and Taxiway Light Fixtures |
| AC 150/5345-47 | Isolation Transformers for Airport Lighting Systems |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |

END OF ITEM L-850

ITEM L-852 TAXIWAY IN-PAVEMENT LIGHTS

DESCRIPTION

852-1.1 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions apply to work specified in this Item.

852-1.2 SCOPE. This Item shall consist of salvaging and reinstalling existing style 3 (aka “flush”) L-852 in-pavement taxiway centerline lights in accordance with these specifications and at the locations shown on the Plans and light fixture schedule. Installation or modification of L-868 bases shall be covered under Section L-867/868.

This Item involves the following work in accordance with these specifications and at the locations shown on the Plans and light fixture schedule:

L-852A.

- a. Salvage and Re-install Existing L-852A Taxiway Centerline Light fixtures with appropriate colored lens on new light bases.
- b. Install new isolation transformers in modified circuit.
- c. Testing fixtures per Item L-100. Photometric Testing shall be under L-100a.

852-1.3 LOCATION/ELEVATION. Lights shall be spaced on centers as indicated on the Plans. Centerline lights shall be located 2'-6" (+0", -6") from taxiway centerline to center of fixture. Longitudinal tolerance is as indicated on the pavement coordination drawings.

Elevation of in-pavement bases shall be set so that, including extension rings, the light fixture flange shall be within +0/-1/8-inch of the finished pavement surface.

852-1.4 IDENTIFICATION NUMBERS. Identification numbers are provided in data tables on the plans for construction purposes.

852-1.5 AIMING.

- a. On Straight Portions. On all straight portions of taxiway centerlines, the axis of the taxiway centerline light (L-852A) beam shall be parallel to the centerline of the taxiway path.

852-1.6 LIGHT BASE AND LIGHT INSTALLATION ALIGNMENT TOOL. The tolerance requirements for location, elevation, and orientation of all light fixtures is of critical importance and must be maintained. In order to do so the light bases and lights shall be installed using an installation and alignment tool. This tool shall be capable of achieving the final alignment specified and shall be of sufficient strength to support the light base during placement and compaction of concrete around the base. Contractor shall submit to Owner's representative the proposed installation and alignment tool for approval. Upon approval, Contractor shall procure a sufficient number of these tools to use in the installation process. No light base or light shall be installed without using an approved installation and alignment tool. All alignment tools shall be turned over to Airport Electrical Maintenance when the project is complete.

852-1.7 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. L-830 Isolation transformers.
- b. Bolts and hardware.
- c. Installation tools and details.

852-1.8 TESTING. Refer to Item L-100 for tests of applicable equipment.

MATERIALS

852-2.1 GENERAL.

- a. Airport lighting equipment and materials covered by advisory circulars (ACs) must be certified and listed in AC 150/5345-53, Airport Lighting Equipment Certification Program, current edition.
- b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.
- c. All equipment and materials furnished and installed in 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. Replacement equipment for the equipment that fails within the guarantee period shall be provided with an extended five (5) year warranty from the date of replacement.

852-2.2 FLUSH IN-PAVEMENT TAXIWAY LIGHT FIXTURES. Types L-852A (narrow beam with green or yellow optical system as indicated on the plans), meeting the requirements of FAA AC 150/5345-46. Lamps shall be 6.6 amp type.

Fixtures shall be suitable for use with 6.6 amp secondary circuits and mount on a 12-inch diameter (Size B) L-868 base can. The reveal above the adjacent pavement surface shall not exceed 0.25-inch. Provide with grounding lug (see Plans).

852-2.3 LIGHT BASE. Light base shall be under Item L-867/868. All bases shall be provided with anti-rotational devices. Provide with grounding lug as shown on the drawings.

852-2.4 TAXIWAY IN-PAVEMENT LIGHT ISOLATION TRANSFORMER. Type L-830, 6.6A, 60 hertz, of the appropriate wattage for the type of associated fixture per manufacturer's recommendation, meeting the requirements of FAA AC 150/5345-47.

852-2.5 HARDWARE. All bolts shall be Type 410 stainless steel. Install using marine grade anti-seize compound. All nuts, washers and lockwashers shall be Type 18-8 stainless steel. Lockwashers shall be 2-piece anti-vibration lock washers.

852-2.6 CABLE. See Item L-108. Type L-824C, 5 kV, and 600 V, meeting the requirements of FAA AC 150/5345-7. The 600V cable for the secondary between the in-pavement fixture, the control

module and isolation transformer shall be incidental to, and integral with, the control module and the L-830 isolation transformer.

852-2.7 PLUG AND RECEPTACLE CABLE CONNECTORS. Type I, Class A, meeting the requirements of FAA AC 150/5345-26. Also see Item L-108.

852-2.8 CONCRETE. Concrete for backfill shall conform to the requirements of Item P-610 Structural Portland Cement Concrete (4,000 psi).

852-2.9 GROUT AND SEALANT. See Item L-867/868.

Prior to application the exposed surfaces of the hole-saw cut shall be sand blasted to a clean, rough surface finish to assure adequate bond between the grout and the Portland cement concrete pavement.

METHOD OF MEASUREMENT

852-3.1 SALVAGE AND REINSTALL IN-PAVEMENT TAXIWAY LIGHTS. The quantity to be measured shall be for the salvage and reinstallation of the existing flush in-pavement taxiway lights on new or existing bases with isolation transformers, connectors, lighting cable, in accordance with the Plans and Specifications and as accepted.

BASIS OF PAYMENT

852-4.1 SALVAGE AND REINSTALL IN-PAVEMENT TAXIWAY LIGHTS. Payment for the salvage and reinstallation of existing flush taxiway lights shall be made at the contract unit price for installing said lights. The unit price shall be full compensation for furnishing all materials and for all preparation, erection and installation of these materials to complete the item.

Payment will be made under:

| | |
|----------------|---|
| Item L-852-4.1 | Remove and Relocate In-pavement L-852A Taxiway Centerline Light with New Isolation Transformer on New Base – Per Each |
|----------------|---|

REFERENCED PUBLICATIONS

852-5.1 FAA SPECIFICATIONS REFERENCED IN L-852 All references shall be current edition.

| | |
|----------------|---|
| AC 150/5340-30 | Design and Installation Details for Airport Visual Aids |
| AC 150/5345-26 | Specification for L-823 Plug and Receptacle, Cable Connections |
| AC 150/5345-42 | Specification for Light Base and Transformer Housings, Junction Boxes and Accessories |
| AC 150/5345-46 | Specification for Runway and Taxiway Light Fixtures |
| AC 150/5345-47 | Isolation Transformers for Airport Lighting Systems |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |

END OF ITEM L-852

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ITEM L-858(L) AIRPORT GUIDANCE LIGHTING SYSTEMS (SIGNAGE)

DESCRIPTION

858-1.1 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions apply to work specified in this Item.

858-1.2 SCOPE. This Item shall consist of internally lighted airport guidance signage furnished and installed in accordance with this specification, the referenced specifications, the manufacturer's recommendations, and the applicable codes, standards and Advisory Circulars. The signs 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 Engineer.

858-1.3 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. Catalog cuts for new internally lighted L-858 guidance signs shall be submitted showing:
 - (1) Sign schedules including sign numbers and face panel descriptions;
 - (2) Message layout for each sign;
 - (3) Sign assembly, including fabrication assembly and internal and external wiring diagrams;
 - (4) Sign and sign base assembly (features and accessories, installation details);
 - (5) Wind load and frangibility load ratings;
 - (6) Load data for all brightness steps, as measured from the primary side of the isolation transformer;
 - (7) Power factor;
 - (8) Lamp life;
 - (9) L-830 Isolation transformer sized appropriately per manufacturer's requirements for sign configuration and type;
 - (10) Manufacturer's statement of warranty (see paragraph 858-2.8 b);
 - (11) Steel L-867 base and steel cover (transformer enclosure.).

- b. Shop drawings shall be submitted showing:
 - (1) Installation requirements (i.e., foundation size, anchor bolt location, etc.);
 - (2) Dimensioned and detailed pre-cast or cast-in-place concrete bases foundations;

In addition to the above specific items, a materials list shall be submitted listing each specification paragraph number and stating whether the materials proposed are as specified or are substitutions. If the item is a substitute item, a complete submittal as described in the above paragraph shall be provided for that item.

858-1.4 MATERIAL DELIVERY SCHEDULE AND REQUIREMENTS. All signs and associated materials (transformers and connecting cables, transformer housings, anchor bolts, floor flanges, breakable couplings, and incidental mounting hardware), for the project shall be procured under this contract in accordance with the material delivery directed by the Engineer. The following material distinction is made to define the material to be delivered:

- a. **Mounting Hardware.** Mounting hardware shall include detailed installation shop drawings as prepared by the sign supplier and approved by the Engineer, transformer housings, anchor bolts and floor flange templates, and sign markers (blank).
- b. **Sign.** Signs shall include the actual sign to be installed, transformer and connecting cables, floor flanges, breakable couplings, tethers, and all other incidentals necessary to provide a complete and operable sign.

EQUIPMENT AND MATERIALS

858-2.1 GENERAL. Taxiway guidance signs, hereinafter referred to as "Signs," shall be retroreflective and shall be the internally illuminated, non-fiber optics type, conforming to AC 150/5345-44, other referenced publications, and to the requirements of this Section. LED signs shall also conform to FAA LED "Engineering Brief No. 67" (current edition). In the event of conflict, the more stringent of these shall apply. The signs shall have a record of having operated successfully for a minimum period of one year at an airport located in the continental United States. The sign manufacturer shall have minimum five years' experience in the manufacture of lighted airfield signs to FAA requirements.

Airport signage equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20591, and shall be listed in Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program, latest edition and Addendum.

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

All equipment and materials furnished and installed in 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. Replacement equipment for the equipment that fails within the guarantee period shall be provided with an extended five (5) year warranty from the date of replacement.

858-2.2 SIGN CLASSIFICATION. The classification of each sign shall be as shown on the Construction Drawings and as specified below:

- a. **Types.** Signs of the following types are included:
 - (1) **Type L-858Y(L).** Direction, Destination, and Boundary Sign. Black legend on a yellow background.
 - (2) **Type L-858L(L).** Taxiway Location Sign. Yellow legend and border on a black background.
 - (3) **Type L-858R(L).** Mandatory Hold Sign. White legend and border on a red background.
- b. **Sizes.** Signs of the following sizes are included:
 - (1) **Size 3. 30-inch** (760 mm) sign face with a 18-inch (460 mm) legend

- c. **Styles.** Signs of the following styles are included:
 - (1) **Style 2.** Powered from a three-step series lighting circuit (4.8-6.6 amperes)
 - (2) **Style 3.** Powered from a five-step series lighting circuit (2.8-6.6 amperes)
- d. **Classes.** Lighted signs of the following classes are included:
 - (1) **Class 1.** For operation down to -4 degrees F (-20 degrees C).
- e. **Modes.** Unlighted signs of the following modes are included:
 - (1) **Mode 2.** To withstand wind loads of 200 mph.
 - (2) **Mode 3.** To withstand wind loads of 300 mph where indicated in Fixture Schedule tables on the E2 Series drawings.

858-2.3 EQUIPMENT TO BE SUPPLIED. The sign shall be complete in accordance with all specification requirements and shall include mounting legs and hardware, electrical disconnect, any required series circuit adapter unit, and an instruction booklet.

858-2.4 ENVIRONMENTAL REQUIREMENT. The signs, including all required components, shall be designed for continuous outdoor use per listed Classes and Modes. The signs shall be capable of withstanding exposure to driving rains.

858-2.5 CONSTRUCTION FEATURES.

- a. **Sign Construction.**
 - (1) Signs shall be constructed of light weight, nonferrous materials, and shall be designed for installation on a concrete pad foundation. All required mounting hardware, except anchor bolts, shall be supplied with the sign. Loose parts shall be tethered to, or otherwise prevented from blowing away from, the installed sign enclosure. All screws or latches shall be the captive type, and shall be easy to open and close.
 - (2) The LED L-858 sign light source shall utilize individual Light Emitting Diode (LED) light tube assemblies. The design of the LED electronics must insure sign lumen maintenance of 70% (L70) minimum for greater than 10 years (assuming sign operates an average of 12 hours per day). A FAA L-858 sign must maintain constant brightness at all CCR step settings.
 - (3) Signs shall be compatible with all existing associating lighting elements (regulators, lights, signs, etc.) on the airfield. Compatibility shall include not causing detrimental effects to the existing airfield lighting elements or not demonstrating detrimental effects due to connection to existing airfield lighting. This compatibility shall be part of the guarantee for the product and any corrective action required shall be at the sole expense of the Contractor.
 - (4) Mounting legs for each sign shall have frangible points located 2 inches or less above the concrete pad foundation. The frangible points shall withstand the required wind loads due to jet blast of 200 or 300 mph, as scheduled on the Fixture Schedule tables on the E2 Series drawings. Legend panels and panel supports shall withstand, at a minimum, the pressure at which the frangible points break. A production sample of two-module sign of proposed signs shall be

tested using an inflatable air bag to verify conformance to the strength requirements herein and FAA AC 150/5345-44. There shall be no permanent deformation to the sign body or face as a result of the test. The strength tests shall be certified by the manufacturer.

(5) Taxiway signs on taxiway edge light circuits shall be Size 3, Style 2 (three step). All signs in runway edge light circuits shall be Size 3, Style 3 (five step).

(6) The color of the sign enclosure shall be black.

(7) The sign shall be completely sealed against sand and dust so that all internal surfaces will remain bright and clean. The lamp(s) shall be easily changeable and all electrical control equipment shall be easily accessible.

b. Tether. Each sign shall be supplied with a minimum of two tethers, with not less than two tethers per five sign legs. The tethers shall be installable such that each sign, when knocked down by a wind of greater than 200 mph, shall remain attached to the sign foundation. Tethers shall be 1/8" stainless steel aircraft cable and shall be secured to the sign enclosure and to a support leg base flange anchor bolt with lock nuts and large diameter washers.

c. Electrical Features.

(1) The signs shall be relampable without the use of tools. Loose parts shall be tethered to, or otherwise prevented from blowing away from, the installed sign enclosure. All screws and latches shall be the captive type.

(2) Power input from the lighting circuit shall be made through an isolation transformer conforming to AC 150/5345-47.

(3) Power input leads shall be at least two feet in length and shall allow for lead termination in a Type 1, Class A, Style 9 receptacle conforming to AC 150/5345-26.

(4) For LED signs, the sign shall impose a low load (VA) on 3-step, 5-step or 5.5A (1-step) constant current regulators using an internal LED power supply circuit contained on one module located inside of the sign. To maximize maintenance personnel safety, there shall be no more than 240Vdc at any point inside the sign. Isolation transformer secondary power wiring shall be routed through the sign leg. The internal LED power supply circuit shall not require field calibration. The LED L-858B sign shall have an input Power Factor >0.82 as measured on the primary of the L-830 or L-831 isolation transformer. Both the fixture input maximum VA load and the maximum CCR load shall be shown on the catalog sheet included with the submittal documents. The electrical design of the sign shall insure conformance with FAA AC 150/5345-44, par. 3.2.5.7. This paragraph states: "The failure of any light source within a sign must not result in a potential miscommunication of the intended message to a pilot. If the failure of an internal lamp(s) in a sign causes a panel or any section of a panel to be dark, or have an average luminance less than the minimum required in paragraph 3.2.5.6, sign operation must be automatically discontinued."

(5) All wiring shall conform to the requirements of NFPA 70. All wiring shall be color-coded and shall be clearly labeled. There shall be no exposed wiring, except for the power cord.

(6) All electrical materials and equipment for which there is a nationally recognized standard shall bear the conformance labeling of the third party inspection authority, such as Underwriters Laboratories, Inc., Factory Mutual, or ETL.

d. Photometrics and Lamp Features.

(1) The ratio of the maximum reading of the light across the face of the signs to the minimum reading of the light output across the face of the signs shall not exceed the value of 5:1.

(2) Type R signs: The ratio of average luminance between message (white) and background (red) shall be not more than 10:1 and not less than 5:1.

(3) Manufacturer shall provide the minimum service life for the lamps in the signs when the sign is operational at its highest step.

(4) Manufacturer shall provide minimum time between failures (MTBF) for

- o Lamps in the signs.
- o Sign intensity control mechanisms

858-2.6 ELECTRICAL DISCONNECT.

a. All signs shall be equipped with a power input disconnect cable terminated with a Type II plug, conforming to the requirements of the latest edition of FAA AC 150/5345-26, Specification for L-823 Plug and Receptacle, Cable Connectors. The length of this cable shall permit the plug end to reach at least 6 inches below the top of the concrete pad on which the sign is mounted. A cable clamp or similar restraining device shall be provided in the sign to prevent strain on the cable terminal connections when the cable plug is pulled apart.

b. An external electrical disconnect switch shall be included in each sign assembly. This switch, when activated, shall de-energize the sign for relamping purposes while maintaining continuity of the series lighting circuit.

858-2.7 SIGN SIZES. The heights of the signs shall be in accordance with the dimensions as follows:

| SIZE | LEGEND HEIGHT | LEGEND PANEL HEIGHT | OVERALL MOUNTING HEIGHT |
|------|---------------|---------------------|-------------------------|
| | (Inches) | (Inches) | (Inches) |
| 3 | 18 | 30 | 36 - 42 |

The lengths of the signs shall be determined by the message to be conveyed, but shall not exceed the maximum length specified by Table 1 of AC 150/5345-44.

858-2.8 SIGN FACES.

- a. The signs shall be either single face (message only on one side) or double face (messages on two sides). The spacing, stroke, shape of legend characters, numerals, symbols, border for Type L-858L(L) sign faces, and message dividers shall be in accordance with FAA AC 150/5345-44.
- b. Contractor and Manufacturer shall provide a warranty for a minimum of three years against the delamination of the surface films from the face of the signs.

858-2.9 PERFORMANCE REQUIREMENTS.**a. Sign Operation.**

- (1) Signs shall be energized and operated at any incoming current value of the series lighting circuit without flickering.
- (2) The luminance level and uniformity of the sign shall be maintained across all series lighting circuit current values, as measured from the primary side of the isolation transformer.
- (3) Power input from the series lighting circuit shall be made through isolation transformers, properly rated, and conforming to AC 150/5345-47.
- (4) Minimum rated operating lamp life, when sign is operated at the highest intensity step, shall not be less than 9,000 hours.

b. Sign Luminance and Color.

- (1) The internally illuminated background of the Type L-858Y(L) sign and the legend of the Types L-858R(L) and L858L(L) signs shall have an average luminance from 10 to 30 footlamberts, with 16 to 30 footlamberts at the 2 highest intensity steps (white or yellow).
- (2) The internally illuminated message of Type L-858B(L) signs shall have a luminance from 29 to 88 foot-lamberts.
- (3) The message of the sign shall be readily identifiable up to a distance of 800 feet when viewed during the day or when lighted at night. Uniformity shall be kept as defined in FAA AC 150/5345-44.
- (4) The sign shall have a uniformity ratio no greater than 5:1 for luminance measured at any 3-inch grid on the sign for a specific color, and no more than 1.5:1 for luminance measured at any adjacent 3-inch grids.
- (5) Contractor shall provide a warranty on the retroreflective material lamination process (paragraph 858-2.8 b.).

858-2.10 FINISH. External surfaces of the signs, excluding the mounting legs and face panel, shall be painted with a primer coat and a low luster, black finish coat. The surface color treatment of the nonmetallic surfaces shall be equal in quality to that obtained on metal surfaces.

858-2.11 NAMEPLATE. Each sign shall have a nameplate giving the Sign Name as shown on the Construction Drawings, Type, Size, Style, Class, manufacturer's name, address, catalog number, and lamp data, including type and rating. The nameplate on Style 2, 3, and 5 signs shall give the total maximum

volt-amp load and power factor as seen from the primary of the isolation transformer. The total maximum volt-amp load indicated shall reflect the highest possible volt-amp loading on the regulator and shall include loading due to a "worst case" isolation transformer, and any required ballast and/or adaptor units. The nameplate shall be mounted to the exterior of the sign enclosure at the top side of the sign.

858-2.12 WORKMANSHIP. The equipment shall be fabricated in accordance with the highest quality workmanship. All wiring shall be neatly run and laced. All sharp edges and burrs shall be removed. Painted surfaces shall be free from runs, blotches, and scratches.

858-2.13 INSTRUCTION BOOKLET. Ten (10) copies of an instruction booklet shall be included with each order of signs, which shall include installation instructions, maintenance procedures (including operating voltage and point readings), and a complete parts list, including recommended spare parts list. It shall also describe the lamp wattage or current needed to maintain the luminance levels specified herein.

858-2.14 SIGN COVER. Sign covers shall be capable of fully covering the sign and withstanding the weather conditions and jet blast to which it may be subjected during its installation. The material shall be sufficiently heavy (similar to canvas) to completely obscure the sign message so that it cannot be read.

858-2.15 SPARES. New installations shall include 15 percent spare lamps, frangible legs, ballasts and PCB power supply units and shall be furnished to airport maintenance.

858-2.16 CONCRETE. Structural Concrete for foundations shall conform to the requirements of Item P-610 Structural Portland Cement Concrete and installed as detailed on drawings.

858-2.17 CONDUIT. Rigid steel and EMT conduit and fittings shall conform to the requirements of Fed. Spec. WW-C-581. PVC conduit and fittings shall conform to the requirements of Item L-110 Airport Underground Electrical Duct Banks and Conduits.

858-2.18 LIGHT BASE. Type L-867, size B, 24-inch-deep, one-piece with 3/8-inch thick steel cover plate meeting the requirements of FAA AC 150/5345-42, current edition, as procured by the Contractor and as provided by the Owner in accordance with Section 24 of the Special Provisions. Provide with grounding lug as shown on the drawings.

858-2.19 ISOLATION TRANSFORMER. An isolating transformer shall be provided with each signs and shall conform to the requirements of the applicable Advisory Circular. Provide with extended secondary connector cable kit. Transformers shall be minimum sized per manufacturer's requirements. Isolation transformer shall conform to the latest edition of FAA AC 150-5345-47, Isolation Transformers for Airport Lighting Systems. The isolation transformer shall be an integrated unit, with power input leads at least 24 inches in length - one lead terminating in a Type I, Class A, Style 2 plug and the other lead in a Type I, Class A, Style 9 receptacle, conforming to the latest edition of FAA AC 150-5345-26, Specification for L-823 Plug and Receptacle, Cable Connectors.

CONSTRUCTION METHODS

858-3.1 GENERAL. The installation and testing details for the systems shall be as specified in the applicable Advisory Circulars.

858-3.2 PHASING AND INTERRUPTIONS. The construction phasing and airfield operational requirements for this project may require that new signs are installed, tested, switched to OFF, and

covered until directed by the Resident Engineer (RE) to activate the signs. Activating the signs will be done as directed by the RE.

858-3.3 LOCATION/ELEVATION. The signs shall be installed at the locations indicated in the plans. Guidance signs shall be located where indicated on the sign data tables in the plans. Longitudinal tolerance is $\pm 1'-0"$. Foundation elevation shall be 1 to 2 inches above finish grade as established on the civil grading and drainage drawings.

858-3.4 TRANSFORMER. The transformer shall be installed in the L-867 base at location and position as indicated on the plans. The primary cable connections shall be made by use of the L-823 plug and receptacle cable connectors and with heat-shrinkable sleeves over the connectors.

858-3.5 HARDWARE. All bolts, nuts, washers and lockwashers shall be stainless steel. Install using anti-seize compound.

858-3.6 CABLE, CONNECTOR, AND ISOLATION TRANSFORMERS. The primary and secondary cable leads of the transformers are supplied with factory-installed molded connectors. Visual inspection of these items during installation is very important. Minor cuts, bruises, or mishandling may result in progressive deterioration which will eventually cause complete failure, but not until some time after acceptance tests. During installation, these items shall be inspected for the following:

- a. The mating surfaces of molded connectors are clean and dry when plugged together. If clean and dry inside, these high voltage connectors, with taping, form a connection equal or superior to a conventional high voltage splice. Conversely, if they are wet or dirty no amount of taping can produce a satisfactory connection. Two or three turns of tape should be used to hold the connector together and keep the parting line clean. Cleanliness of mating surfaces can be ensured by keeping the factory-installed caps in place until the final connection is made. The mating surfaces of uncapped connectors should not be laid down, touched, or breathed upon. If a connection must be broken, the connectors should be immediately capped.
- b. The connectors are completely plugged together. After initial plugging, trapped air pressure may partially separate the plug and receptacle. If this happens, wait a few seconds and push them together again. Two or three turns of tape should be used to hold them in place.
- c. The cables are not cut by shovels, kinked, crushed by vehicle wheels, bruised by rocks, or damaged in any way during handling and installation.
- d. The cables do not directly cross each other and are separated by the specified distance.
- e. The cables are not bent sharply where they enter (or leave) a conduit, and are supported properly by tamped ground so future settling will not cause sharp bends.

858-3.7 IDENTIFICATION NUMBERS. An identifying number shall be assigned to each sign in accordance with the drawings. The placing of these numbers shall be accomplished by use of 2-inch diameter nonferrous metal tag, with the numerals approximately 1/4-inch in height, stamped in, embedded in the concrete base as detailed on the drawings, so each faces the taxiway or runway.

858-3.8 FIELD TESTS AND INSPECTIONS

- a. Contractor shall provide the RE ten (10) working days notice prior to test(s). All deficiencies found shall be corrected and tests repeated.

b. Operation. Upon completion of all the tests required under other sections, the Contractor shall show by in-service demonstration that all circuits, control equipment, and all lights covered by the contract are in good operating condition. The testing of each circuit shall be made using local control switches on the regulators in each lighting vault. Each switch shall be operated so that each switch position is engaged at least five times. During this process, all lights and associate equipment shall be observed to determine that each circuit operates properly. Telephone or radio communication between the operator and the observers shall be provided. The above tests shall be repeated from the alternate control station, from the remote control points, and also again from the local control switches on the regulators. Each lighting circuit shall be tested by operating the lighting circuits at each brightness step. Visual examination shall be made at the beginning and at the end of this test to determine that the correct signs are energized.

c. ELECTRICAL TESTS ON CABLES. See Item L-108.

METHOD OF MEASUREMENT

858-4.1 NEW L-858(L) SIGNS ON NEW FOUNDATIONS. This Item shall consist of the installation of each new sign which shall include: Furnishing and installing each configuration of new L-858 sign, with lamps and isolation transformer, mounting supports and hardware on a new concrete foundation (under Item L-867/L-868: including light base, counterpoise loop and ground rod). Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

858-4.2 REMOVE AND RELOCATE L-858 SIGN ON NEW FOUNDATION. This Item shall consist of the reinstallation of each salvaged internally lighted retroreflective sign which shall include: installing each salvaged L-858 sign, furnishing and installing new isolation transformer, new lamps and mounting hardware (existing flanges may be reused) on a new concrete foundation (under Item L-867/L-868: including light base, counterpoise loop and ground rod). Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

BASIS OF PAYMENT

858-5.1 NEW L-858(L) SIGNS ON NEW FOUNDATIONS. Payment for the installation of new signs shall be made at the contract unit price for furnishing and installing each configuration of sign. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item. Payment for furnishing and installing the concrete sign foundation shall be paid under Item L-867/868 for each configuration of sign.

858-5.2 REMOVE AND RELOCATE L-858 SIGN ON NEW FOUNDATION. Payment for the installation of relocated retroreflective signs shall be made at the contract unit price for installing each configuration of sign. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item as accepted by the Owner. Payment for furnishing and installing the concrete sign foundation shall be paid under Item L-867/868 for each configuration of sign.

Payment will be made under:

| | |
|----------------|--|
| Item L-858-5.1 | New Size 3, 1-Module Airside LED Guidance Sign, Installed on Any Foundation – per each |
| Item L-858-5.2 | New Size 3, 2-Module Airside LED Guidance Sign, Installed on Any Foundation – per each |

| | |
|----------------|--|
| Item L-858-5.3 | New Size 3, 3-Module Airside LED Guidance Sign, Installed on Any Foundation – per each |
| Item L-858-5.4 | New Size 3, 4-Module Airside LED Guidance Sign Installed on Any Foundation – per each |
| Item L-858-5.5 | Remove and Relocate Size 3, Any-Module Airside Guidance Sign, Installed on New Foundation – per each |

REFERENCED PUBLICATIONS

858-6.1 FEDERAL SPECIFICATIONS REFERENCED IN ITEM L-858.

| | |
|----------|---|
| WW-C-581 | Conduit, Metal, Rigid; and Coupling, Elbow; and Nipple, Electrical Conduit: Zinc-Coated |
| W-C-1094 | Conduit, Plastic-Type II Schedule 40 |

858-6.2 FAA SPECIFICATION REFERENCED IN L-858. All references are current edition.

| | |
|----------------|---|
| AC 150/5340-18 | Standards for Airport Sign Systems |
| AC 150/5340-30 | Design and Installation Details for Airport Visual Aids |
| 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 150/5345-44 | Specification for Taxiway and Runway Signs |
| AC 150/5345-47 | Isolation Transformers for Airport Lighting Systems |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |

END OF ITEM L-858

ITEM L-861T ELEVATED MEDIUM INTENSITY TAXIWAY EDGE LIGHTS

DESCRIPTION

861T-1.1 SCOPE. This Item shall consist of the installation of various elevated fixtures in accordance with these specifications and at the locations shown on the Plans and Light Fixture Schedule. Installation or modification of L-86t bases shall be covered under Section L-867/868.

861T-1.2 GENERAL. This Item involves the following work.

- a.** Furnishing and installing new L-861T(L) medium intensity taxiway edge lights (MITL), including new isolation transformers and connectors as detailed on the plans.
- b.** Salvaging and reinstalling L-861T(L) medium intensity taxiway edge lights including new isolation transformers and connectors as detailed on the plans.
- c.** Salvaging and reinstalling L-861T (Quartz) medium intensity taxiway edge lights including new isolation transformers and connectors as detailed on the plans.
- d.** Testing fixtures per Item L-100.
- e.** Installation or modification of L-867 bases shall be paid for and specified under Section L-867/868.

861T-1.3 APPLICABLE DOCUMENTS. The publications listed at the end of this Item are incorporated herein by reference and form a part of this Item to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of this solicitation shall be applicable. In the text of this Item, such publications are referred to by basic designation only. Additional details and specifications pertaining to a specific system are contained in these documents and are to be considered as part of this Item. Perform all work in accordance with these documents except as specified herein. In the event of a conflict between contract documents and the referenced documents, the more stringent rule shall be applied.

861T-1.4 IDENTIFICATION NUMBERS. An identifying number shall be assigned to each permanent light in accordance with the drawings. The placing of these numbers shall be accomplished by use of 2-inch diameter nonferrous metal tag, with the numerals approximately 1/4-inch in height, stamped in, embedded in the concrete base as detailed on the drawings, so each faces the nearest point on the taxiway centerline.

861T-1.5 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions apply to work specified in this Item.

861T-1.6 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.6, for the following equipment:

- a.** L-861T(L) Light fixture.
- b.** L-830 Isolation transformer.
- c.** L-823 Cable connector.

861T-1.7 LOCATION/ELEVATION. New lights shall be spaced on centers as indicated on the drawings. Longitudinal tolerance is +/- 6 inches. Elevation of bases shall be coordinated with the existing grade. The base shall be set so that the light fixture base plate shall be within +1 to +2-inch of the finished grade.

MATERIALS

861T-2.1 GENERAL. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20590, and shall be listed in Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program, current edition and Addendum.

861T-2.2 MEDIUM-INTENSITY ELEVATED TAXIWAY LIGHT FIXTURES. Type L-861T(L), LED, omni-directional, meeting the requirements of FAA AC 150/5345-46, current edition. Lights shall have blue optical systems. Installed height to top of globe shall be 14 inches above base.

861T-2.3 LIGHT BASE. Type L-867, Size B, two-piece or extension type light base and base plate shall be under Item L-867/868. Provide with grounding lug as shown on the drawings.

For installation in PCC, Type L-868, Size B, two piece light base and base plate shall be under Item L-867/868. Provide with grounding lug as shown on the drawings.

861T-2.4 ISOLATION TRANSFORMER. Type L-830, 10/15 watts for L-861T(L) and 35/45 watts for L-861T, 60 hertz, meeting the requirements of FAA AC 150/5345-47, current edition.

861T-2.5 HARDWARE. All bolts, nuts, washers and lock washers shall be stainless steel. Install using anti-seize compound.

861T-2.6 PLUG AND RECEPTACLE CABLE CONNECTORS. L-823, Type I, Class A, meeting the requirements of FAA AC 150/5345-26, current edition.

861T-2.7 CONCRETE. Concrete for foundations shall conform to the requirements of Item P-610 "Structural Portland Cement Concrete."

METHOD OF MEASUREMENT

861T-3.1 NEW ELEVATED TAXIWAY EDGE LIGHTS. The quantity to be measured shall be for the installation of each new elevated medium intensity LED lamp taxiway edge light fixture with appurtenances (base plate, stem, frangible coupling and isolation transformer with secondary cable assembly), on an existing base or on a new base (under Item L-867/L-868: including light base, safety ground and ground rod). Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

861T-3.2 SALVAGE AND REINSTALL TAXIWAY EDGE LIGHTS. The quantity to be measured shall be for the salvage and reinstallation of each existing elevated edge light fixture with appurtenances (base plate, stem, frangible coupling and isolation transformer with secondary cable assembly), on an existing base or on a new base (under Item L-867/L-868: including light base, safety ground and ground rod). Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

BASIS OF PAYMENT

861T-4.1 NEW ELEVATED TAXIWAY EDGE LIGHTS. Payment for the installation of new elevated medium intensity taxiway edge lights shall be made at the contract unit price for furnishing and installing each fixture. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item. Payment for furnishing and installing the L-867 or L-868 base shall be paid under Item L-867/868.

861T-4.2 SALVAGE AND REINSTALL TAXIWAY EDGE LIGHTS. Payment for the salvage and reinstallation of existing elevated edge lights shall be made at the contract unit price for installing said lights. The unit price shall be full compensation for furnishing all materials and for all preparation, erection and installation of these materials to complete the item. Payment for furnishing and installing the L-867 base shall be paid under Item L-867/868.

Payment will be made under:

| | |
|-----------------|--|
| Item L-861T-4.1 | New L-861T LED Taxiway Edge Light with New Isolation Transformer on New Base - per each |
| Item L-861T-4.2 | Salvage and Reinstall L-861T LED Taxiway Edge Light with New Isolation Transformer on New Base - per each |
| Item L-861T-4.3 | Salvage and Reinstall L-861T Quartz Taxiway Edge Light with New Isolation Transformer on New Base - per each |

REFERENCED PUBLICATIONS

861T-5.1 FAA SPECIFICATIONS REFERENCED IN L-861T. All references shall be current edition.

| | |
|----------------|---|
| AC 150/5340-30 | Design and Installation Details for Airport Visual Aids |
| 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 150/5345-46 | Specification for Runway and Taxiway Light Fixtures |
| AC 150/5345-47 | Isolation Transformers for Airport Lighting Systems |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |

END OF ITEM L-861T

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ITEM L-862 ELEVATED HIGH INTENSITY RUNWAY EDGE LIGHTS

DESCRIPTION

862-1.1 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions apply to work specified in this Item.

862-1.2 GENERAL. This Item shall consist of the following:

- a. Salvage and re-install existing L-862 high intensity runway edge lights (HIRL), including new isolation transformers and connectors as detailed on the plans.
- b. Salvage and re-install existing L-862E high intensity runway end/threshold lights (HIRL), including new isolation transformers and connectors as detailed on the plans.
- c. Testing fixtures per Item L-100.
- d. L-867 bases shall be furnished and installed in accordance with Item L-867/868.

862-1.3 APPLICABLE DOCUMENTS. The publications listed at the end of this Item are incorporated herein by reference and form a part of this Item to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of this solicitation shall be applicable. In the text of this Item, such publications are referred to by basic designation only. Additional details and specifications pertaining to a specific system are contained in these documents and are to be considered as part of this Item. Perform all work in accordance with these documents except as specified herein. In the event of a conflict between contract documents and the referenced documents, the more stringent rule shall be applied.

862-1.4 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. L-830 Isolation transformer.
- b. L-823 Cable connector.

862-1.5 LOCATION/ELEVATION. Lights shall be spaced on centers as indicated on the drawings. Longitudinal tolerance is +/-6 inches. Elevation of bases shall be coordinated with the civil grading and drainage drawings. The base shall be set so that the light fixture base plate shall be within +1 to +2-inch of the finished grade.

862-1.6 IDENTIFICATION NUMBERS. Identification numbers are provided in data tables on the plans for construction purposes.

862-1.7 TESTING. Refer to Item L-100, Paragraph 100-3.10 and Item L-100a, Paragraph 100a-1.3 for tests of applicable equipment.

MATERIALS

862-2.1 GENERAL. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C.

20590, and shall be listed in Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program, current edition and Addendum.

862-2.2 LIGHT FIXTURES. L-862 and L-862E light fixtures shall meet the requirements of FAA AC 150/5345-46, current edition. Lights shall be fitted with colored optical systems as shown on the plans. Installed height to top of globe shall be 14 inches above base. Lamps shall be 150 watts for L-862 and 200 watts for L-862E, 6.6 amp quartz type.

862-2.3 LIGHT BASE. Type L-867, Size B, two-piece or extension type, per Item L-867. Provide with grounding lug as shown on the drawings. L-867 bases shall be paid for and specified under Section L-867/868.

862-2.4 ISOLATION TRANSFORMER. Type L-830, 150 watts for L-862 and 200 watts for L-862E, 60 hertz, meeting the requirements of FAA AC 150/5345-47, current edition.

862-2.5 HARDWARE. All bolts, nuts, washers and lock washers shall be stainless steel. Install using Loctite® Threadlocker Blue 242, Permatex® Medium Strength Threadlocker Blue, or approved equal.

861T-1.2 PLUG AND RECEPTACLE CABLE CONNECTORS. L-823, Type I, Class A, meeting the requirements of FAA AC 150/5345-26, current edition.

METHOD OF MEASUREMENT

862-3.1 SALVAGE AND REINSTALL RUNWAY EDGE LIGHTS. The quantity to be measured shall be for the salvage and re-installation of each elevated High intensity runway edge or threshold/end light fixture with appurtenances (new isolation transformer with secondary cable assembly) on new or existing base. Work shall include connections and testing in accordance with the plans and specifications and as accepted by the Owner.

BASIS OF PAYMENT

862-4.1 SALVAGE AND REINSTALL ELEVATED RUNWAY EDGE LIGHTS. Payment for the salvage and re-installation of each existing elevated High intensity runway edge or threshold/end light fixture shall be made at the contract unit price for installing said lights. The unit price shall be full compensation for all labor, materials, equipment, testing and incidentals necessary to complete the Item. Payment for new L-868 base shall be paid under Item L-867/868.

Payment will be made under:

- Item L-862-4.1 Salvage and Reinstall Elevated L-862 Runway Edge Light with New Isolation Transformer on New Base --per each
- Item L-862-4.2 Salvage and Reinstall Elevated L-862E Runway Threshold/End Light with New Isolation Transformer on Existing Base --per each

REFERENCED PUBLICATIONS

862-5.1 FAA SPECIFICATIONS REFERENCED IN L-862. All references shall be current edition.

| | |
|----------------|---|
| 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 150/5345-42 | Specification for Airport Light Bases, Transformer Housings, Junction Boxes and Accessories |
| AC 150/5345-46 | Specification for Runway and Taxiway Light Fixtures |
| AC 150/5345-47 | Isolation Transformers for Airport Lighting Systems |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |

END OF ITEM L-862

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ITEM L-867/868 LIGHT BASE AND TRANSFORMER HOUSING

DESCRIPTION

867/868-1.1 SCOPE. This Item shall consist of the installation of various junction cans, fixture bases, sign foundations, transformer housings and/or appurtenances for the following work:

- a. L-867 bases and covers for use for miscellaneous system cable splices.
- b. L-867 bases and appurtenances for any Elevated Fixture (Runway and Taxiway Edge Lights, future Runway Guard Lights or Stop Bar Lights).
- c. L-868 bases and appurtenances for any In-pavement Fixture (Taxiway Centerline Lights, Runway Edge Lights, future Runway Guard Lights or Stop Bar Lights).
- d. Installation methods for L-868 base shall include the following options:
 - (1) "Standard" two-step installation (base and appurtenances (grounding, rebar cage, etc.) set in concrete, plus shallow core drill for extension to final grade).
 - (2) Either of two "Core Drill" installations (full depth core drill with concrete in-fill) for fixtures at paving lane or saw cut joints.
 - (3) The "Diamond Leave-out" installations (form around base location with concrete in-fill) at intersections of paving lanes and saw cut joints where fixture cannot be moved far enough to avoid the intersection.
- e. Blank covers for new or vacated existing L-867 bases.
- f. Aircraft load rated blank covers for new or vacated existing L-868 bases.
- g. L-868 to L-867 Adaptor Ring for mounting elevated edge fixtures on in-pavement bases.
- h. Guidance sign foundations (furnish & install signs are under Item L-858).

867/868-1.2 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions apply to work specified in this Item.

867/868-1.3 SHOP DRAWINGS AND MATERIAL LISTS. Shall be in accordance with Item L-100, Paragraph 100-1.5, for the following equipment:

- a. Bases, extensions, rings and adaptor rings.
- b. Flange Rings.
- c. Blank cover plates.
- d. Bolts and hardware.
- e. Sign foundations shop drawings.
- f. Base installation technique and associated equipment (refer to paragraph 1.5 "LIGHT BASE AND LIGHT INSTALLATION LEVELING AND ALIGNMENT TOOL").

867/868-1.4 LOCATION/ELEVATION. Bases shall be located as indicated on the drawings.

Elevation of in-pavement bases shall be coordinated with the civil grading and drainage drawings per the requirements of Item L-850.

Elevation of in asphalt shoulder bases shall be coordinated with the civil grading and drainage drawings per the requirements of Item L-861T and Item L-862.

867/868-1.5 LIGHT BASE AND LIGHT INSTALLATION ALIGNMENT TOOL. The tolerance requirement for location, elevation, and orientation of all light fixtures is of critical importance and must be maintained. In order to do so the light bases and lights shall be installed using an installation and alignment tool. This tool shall be capable of achieving the final alignment specified and shall be of sufficient strength to support the light base during placement and compaction of concrete around the base. The Contractor shall submit to the Engineer the proposed installation and alignment tool for approval. Upon approval, the Contractor shall procure a sufficient number of these tools to use in the installation process. No light base or light shall be installed without using an approved installation and alignment tool.

MATERIALS

867/868-2.1 GENERAL. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20590, and shall be listed in Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program, current edition and Addendum.

867/868-2.2 CONSTRUCTION.

- a. Steel shall be used in the construction of L-867 and L-868 bases, extensions, and accessories and shall meet the requirements of ASTM A-36. All welds shall be continuous to provide a watertight enclosure. All bases, sections, and extensions shall meet the test requirements in Item L-867/868-2.15.
- b. Construction of PVC, polyethylene plastic or other non-metallic materials for L-868 and L-867 bases will not be accepted.

867/868-2.3 TOP FLANGE. The dimensions of the flange and its bolt circle shall be as required for the appropriate fixture. The flat surface of the flange shall be installed at an angle of 90 degrees, plus or minus 0.25 degree, to the axis of the cylindrical body. The flange shall be continuously attached to the body to provide a watertight seal.

867/868-2.4 BODY. The dimensions of the base and/or extension shall be as shown on the plans. Two duct couplings or grommets shall be provided and installed near the bottom of the base as shown on the plans. The location and size, as shown on the plans, shall be considered standard. However, the location, number, type, and size of the duct connections can be altered to meet special conditions. Any sharp edges formed on the inside of the bases where duct couplings meet the inside surface of the housing shall be removed to prevent cutting of cable insulation at these points. The length of the body section as shown in the plans shall be considered standard, but the length may vary to meet special conditions. Extensions may vary in height as required to the closest 1/16 inch.

L-868 bases and extensions shall be provided with anti-rotational lugs and/or fins welded to the steel body prior to galvanizing.

867/868-2.5 L-867 LIGHT BASE ASSEMBLY. Type L-867, Size B, two-piece or extension type, meeting the requirements of FAA AC 150/5345-42. Refer to Item L-867/868 for base and base plate specifications. Provide with grounding lug as shown on the drawings.

867/868-2.6 L-868 LIGHT BASE ASSEMBLY. Type L-868, size B, 24-inch-deep, one or two-piece meeting the requirements of FAA AC 150/5345-42, current edition. Provide with grounding lug as shown on the drawings.

867/868-2.7 FLANGE RINGS, EXTENSIONS, RINGS AND SHIMS. All L-850 type fixtures shall be installed on flange rings (AKA dam ring).

Each L-868 base will be provided with, as indicated, a flange ring and one steel extension ring with appropriate bolt-hole pattern. The Contractor is required to maintain an adequate supply of grade adjustment shims on the project site at all times.

All L-868 bases installed in concrete pavement shall be installed with no more than one spacer ring of a thickness as required to accommodate conduit depths with existing grade.

NOTES:

1. Each L-868 base can and extension for future L-852G fixtures shall be provided with 12-bolt hole pattern top flange, spacer ring(s) and flange ring.

867/868-2.8 HARDWARE. Bolts and lock washers shall be supplied with each base and extension assembly. The bolts shall conform to dimensions specified in the AC light base manufacturer specifications.

- a. All bolts for L-867 bases shall be fabricated from 18-8 stainless steel. Install with Loctite® Threadlocker Blue 242, Permatex® Medium Strength Threadlocker Blue, or approved equal.
- b. All bolts for L-868 bases shall be fabricated from Type 410 stainless steel. Install using marine grade anti-seize compound. All nuts, washers and lockwashers shall be Type 18-8 stainless steel.
- c. Lock washers shall be 2-piece anti-vibration lock washers. Split type of locking washer shall not be allowed.
- d. All bolts must be of sufficient length so that a minimum of 2 threads extends beyond the inside base flange.

867/868-2.9 "MUD" COVERS. Plywood protection and installation covers shall be fabricated according to the details and dimensions compatible with bases to be installed. The covers shall be fabricated from exterior grade plywood or a material of equal strength and weather resistance.

867/868-2.10 BLANK COVERS. Blank covers for L-868 bases shall be steel, minimum 3/4-inch thick, with traffic rating of 100,000 pounds. Blank covers for L-867 bases shall be steel, nominal 3/8-inch thick. Covers used temporarily during construction/paving may be reused in permanent installations at project completion. Any remaining covers shall be turned over to Airport Maintenance at job completion, if requested by the Owner. Otherwise, Contractor shall dispose of all remaining covers off site.

867/868-2.11 ADAPTOR RINGS. L-868 to L-867 adaptor rings shall be steel, 3/4-inch thick, designed for conversion from L-868 base bolt pattern to standard L-867 bolt pattern to allow the installation of standard elevated fixture base plates.

867/868-2.12 GROMMETS. Grommets supplied for duct entrances into bases shall be sized to provide a watertight connection and be made of a material suitable for direct earth burials or encasement by asphalt, Portland cement concrete, or epoxy sealers. The grommet material shall have a hardness of 50 +/-5 as determined by a durometer (ASTM D-2240). Typical grommet details are shown on the plans.

867/868-2.13 GROUNDING LUGS. An internal ground connector shall be supplied with each L-867 or L-868 base and for / on each L-867 fixture base plate (see drawings). For steel bases, a steel lug shall be welded to the interior wall of each base before galvanizing. The details and location of the grounding lug are shown on the plans. The location of the lug may be varied to meet specified conditions. three-hole bronze or copper ground connector shall be fastened to the steel lug after galvanizing.

867/868-2.14 PROTECTIVE COATING. After fabrication, burrs and sharp edges shall be removed, and all metal parts shall be treated for corrosion protection. Prior to tapping operations, all parts of bases, junction boxes, spacer rings in excess of 1/4-inch in thickness, extensions, and conversion rings shall be hot-dip galvanized as specified in ASTM A-386, Class A, and applied in accordance with ASTM A-385. Base flanges, covers, and rings shall be wiped smooth to a flatness of +0.010 inch. Mud plates, grooved spacer rings, and other spacer rings 1/4-inch or less in thickness shall be plated with zinc in accordance with the requirements of Federal Specification QQ-Z-325, Type II, Class 1, or with cadmium in accordance with the requirements of Fed. Spec. QQ-P-416, Type II, Class 1. Tapped holes shall be protected with a polyurethane varnish or equivalent. A zinc dust primer meeting MIL-P-26915 (USAF) shall be permitted for touchup. The area covered by zinc dust primer shall not exceed 10 percent of the total treated area. Any case iron may be coated with a minimum of 2.0 mils of oxyplast powder in lieu of galvanizing.

867/868-2.15 QUALIFICATION TEST. Tests shall be in accordance with FAA AC 150/5345-42, latest edition.

PREPARATION FOR DELIVERY

867/868-3.1 BASES - PACKING. Each unit shall be individually packed as follows: The flange surface of each light base and transformer housing shall be protected by a cover as described in Paragraph 2.14 herein. A polyethylene gasket of 3-mil thickness shall be placed between the shipping cover and the base flange. The shipping cover shall be bolted to the flange by means of size 3/8, 16 hex-head stainless steel machine bolts seated to 25 inch-pounds of torque. Threaded duct entrances shall be protected with an anti-seize compound and standard thread protectors.

867/868-3.2 BASES - MARKING. Light bases and transformer housing, extensions, and accessories shall be marked for shipment with consignee's name and address, manufacturer's name and address, and other pertinent information as needed by the installer to identify non-standard length bases, special extensions, or other accessories.

CONSTRUCTION METHODS

867/868-4.1 LIGHT BASES. Light bases shall be installed at the locations shown on the plans. The bases shall be installed per the details shown on the plans. The standard base can configuration shall include two drilled openings toward the bottom of the base for the installation of the conduit grommets. The Contractor shall drill, in the appropriate location(s), any additional openings for additional conduit entries. **The equipment ground of Item L-108-3.4 shall be incidental to the installation of each base, light or sign.**

867/868-4.2 CONDUIT CONNECTIONS. Prior to concrete encasement, conduit connections shall be made at the base hubs to form a watertight connection as shown on the plans.

867/868-4.3 EXCAVATION AND BACKFILL. Refer to details on the plans for the various installation configurations. The cover plates shall be visible and free of debris following completion of the backfill.

867/868-4.4 CONCRETE. Concrete for backfill shall conform to the requirements of Item P-610 Structural Portland Cement Concrete (4,000 psi).

867/868-4.5 GROUT AND SEALANT. Filling/sealing grout used to encase in-pavement transformer/light bases in concrete shall meet FAA Specification P-605 and shall be a two-component liquid, resilient and adhesive sealant for use in waterproofing nonmoving joints in Portland cement concrete pavement. Filling/sealing sealant used to encase in-pavement transformer/light bases in asphalt shall meet FAA Specification P-605 and shall meet the requirements of ASTM D 5249, Joint Sealants, for bituminous pavements, and applicable section(s) of FAA Specification Item P-605. Each lot or batch of sealing compound shall be delivered to the job site in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and the safe heating temperature and shall be accompanied by the manufacturer's certification stating that the compound meets the requirements of this specification.

Prior to application the exposed surfaces of the hole-saw cut shall be sand blasted to a clean, rough surface finish to assure adequate bond between the grout and the Portland cement concrete pavement (PCCP).

METHOD OF MEASUREMENT

867/868-5.1 SIZE "B" L-867 BASE FOR ANY NEW ELEVATED OR REINSTALLED FIXTURE. The quantity to be measured shall be for furnishing and installing, in new shoulder pavement, core drilled in existing shoulder pavement, or in unpaved shoulders each new L-867 base can per details on drawing E3.3, with appurtenances, installation of ground rod, safety ground connections, and testing in accordance with the Plans and Specifications and as accepted by Owner.

867/868-5.2 SIZE "B" L-868 BASE CAN FOR ANY NEW OR REINSTALLED ELEVATED OR IN-PAVEMENT FIXTURE - "CORE DRILL" INSTALLATION AT JOINT OR SAWCUT. The quantity to be measured shall be for furnishing and installing each new L-868 base can per details on drawings E3.4 and E3.5, with appurtenances, core drilling, concrete encasement, installation of ground rod, safety ground connections, and testing in accordance with the Plans and Specifications and as accepted by Owner.

867/868-5.3 SIZE "B" L-868 BASE CAN FOR ANY NEW OR REINSTALLED IN-PAVEMENT FIXTURE - "TANGENT CORE DRILL" INSTALLATION AT JOINT OR SAWCUT. The quantity to be measured shall be for furnishing and installing each new L-868 base can per detail on drawing E3.5, with appurtenances, forming or coring & saw cutting, concrete encasement, installation of ground rod, safety ground connections, and testing in accordance with the Plans and Specifications and as accepted by Owner.

867/868-5.4 SIZE "B" L-868 BASE CAN FOR ANY NEW OR REINSTALLED IN-PAVEMENT FIXTURE - "DIAMOND LEAVE OUT" INSTALLATION AT JOINT OR SAWCUT. The quantity to be measured shall be for furnishing and installing each new L-868 base can per detail on drawing E3.5, with appurtenances, forming, concrete encasement, installation of ground rod,

safety ground connections, and testing in accordance with the Plans and Specifications and as accepted by Owner.

867/868-5.5 MODIFY SIZE "B" L-868 BASE CAN FOR ANY NEW OR REINSTALLED IN-PAVEMENT FIXTURE IN EXISTING PCCP. The quantity to be measured shall be for modifying each existing L-868 base can per details on drawing E3.2, with appurtenances, core drilling, concrete encasement, installation of ground rod, safety ground connections, and testing in accordance with the Plans and Specifications and as accepted by Owner.

867/868-5.6 BLANK COVERS AND ADAPTOR RINGS. The quantity to be measured shall be for furnishing and installing each new blank covers or adaptor rings for L-867 or L-868 bases with appurtenances (bolts, gaskets, etc.), in accordance with the Plans and Specifications and as accepted by Owner.

867/868-5.7 CONCRETE FOUNDATIONS AND BASE ASSEMBLIES FOR SIGNS. The quantity to be measured shall be for furnishing and installing each concrete sign foundation assembly per details on drawing E3.1, each with new L-867 base can with appurtenances, installation of ground rod, and testing in accordance with the Plans and Specifications and as accepted by Owner

BASIS OF PAYMENT

867/868-6.1 L-867 OR L-868 BASES. Payment for the installation of new or modified bases for various applications will be paid for at the contract unit price per each type of assembly complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, concrete, backfilling and placing of the materials; furnishing and installing connections to conduits as may be required to complete the item as shown on the Plans; and for all labor, equipment, tools, and incidentals necessary to complete the work.

867/868-6.2 BLANK COVERS AND ADAPTOR RINGS. Payment for the installation of each new blank cover or adaptor ring for L-867 or L-868 bases will be paid for at the contract unit price per each type of assembly complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, concrete, backfilling and placing of the materials; furnishing and installing connections to conduits as may be required to complete the item as shown on the Plans; and for all labor, equipment, tools, and incidentals necessary to complete the work.

867/868-6.3 CONCRETE FOUNDATIONS AND BASE ASSEMBLIES FOR SIGNS. Payment for the installation of each new sign foundation will be paid for at the contract unit price per each sign configuration foundation complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, concrete, backfilling and placing of the materials; furnishing and installing connections to conduits as may be required to complete the item as shown on the Plans; and for all labor, equipment, tools, and incidentals necessary to complete the work. Installation of signs onto concrete foundations shall be incidental to bid items in L-858 for each sign configuration.

Payments will be made under:

| | |
|--------------------|---|
| Item L-867/868-6.1 | Size "B" L-867 Base Can for Any New, Reinstalled or Future Fixture in New Asphalt Shoulder – per Each |
| Item L-867/868-6.2 | Size "B" L-867 Base Can for Any New, Reinstalled or Future Fixture in Non-Paved Shoulder – per Each |

| | |
|---------------------|--|
| Item L-867/868-6.3 | Size "B" L-868 Base Can – "Standard Installation (New PCCP)" – per Each |
| Item L-867/868-6.4 | Size "B" L-868 Base Can – "Core Drill New PCCP" Installation at Joint or Sawcut – per Each |
| Item L-867/868-6.5 | New Size "B" L-867 Blank Base Can Cover – per Each |
| Item L-867/868-6.6 | New Size "B" L-868 Blank Base Can Cover – per Each |
| Item L-867/868-6.7 | New Size "B" L-868 Flange Ring and Spacer – per Each |
| Item L-867/868-6.8 | Core Drill Replace L-868 in (E) PCCP – per Each |
| Item L-867/868-6.9 | Core Drill L-868 Extension & Flange in (E) PCCP – per Each |
| Item L-867/868-6.10 | Concrete Foundation for 1-Module Sign – per Each |
| Item L-867/868-6.11 | Concrete Foundation for 2-Module Sign – per Each |
| Item L-867/868-6.12 | Concrete Foundation for 3-Module Sign – per Each |
| Item L-867/868-6.13 | Concrete Foundation for 4-Module Sign – per Each |
| Item L-867/868-6.14 | Concrete Foundation for 2+4-Module Sign – per Each |

REFERENCED PUBLICATIONS

867/868-7.1 FAA SPECIFICATIONS REFERENCED IN L-867/868. All references are current edition.

| | |
|----------------|---|
| AC 150/5345-42 | Specification for Airport Light Bases, Transformer Housings, Junction Boxes and Accessories |
| AC 150/5345-53 | Airport Lighting Equipment Certification Program |

END OF ITEM L-867/868

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DIVISION F

STORMWATER AND OTHER SPECIFICATIONS

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STORMWATER AND OTHER SPECIFICATIONS

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100 MOBILIZATION

100.1. DESCRIPTION:

- A. Mobilization shall consist of preparatory work and operations, including but not limited to, installation of staging area temporary utilities, the movement of personnel, equipment, materials, supplies and incidentals to the project site, and for transportation of buildings, Quality Control personnel, laboratory field testing equipment and tools, testing supplies, haul roads and other facilities necessary to complete the Work on the project including providing one or more staging areas with temporary security fence and gate(s). This item is also for the Contractor's operations, and material storage for the Contractor. This item is for other work and operations that the Contractor must perform or costs he must incur before beginning work on the project, and for necessary work and costs in completing the construction and demobilizing from the site.

Demobilization costs may include, but not be limited to, removal of temporary utilities to the staging area and concrete batch plant(s), removal of temporary field offices and materials laboratories, demobilization of equipment, and the clean-up and restoration of the construction staging area, the concrete batch plant(s) and materials laboratories location.

- B. Contractor Staging Area: The Contractor shall provide an **off airport staging area** for his use during the duration of this project. This area shall be used for the Contractor's operations, the storage of materials, equipment parking, cement silos, batch plants or other equipment required for the construction of this project. The Contractor shall provide utility services to the site and all permits needed to use the temporary staging area. The Airport reserves the right to direct the Contractor to correct any deficiencies in the maintenance of the staging yard and the Contractor shall promptly comply with the directives of the Engineer. The Contractor is required to Comply with the requirements of the property owner when finished with this property and restore it to the prior condition. Prior to commencement of work, the Contractor shall document the existing conditions of the proposed staging area and haul routes. Acceptable documentation shall include photographs and video documentation. All documentation shall be submitted to the Engineer prior to beginning work.

The safety, convenience, and the protection of persons and property, of the general public and residents along the streets, highways and areas adjacent to the work areas shall be provided by the Contractor. The Contractor shall at all times so conduct his work as to assure the least possible obstruction to traffic and adjacent residents.

The Contractor shall submit a staging area layout and operations plan for approval before equipment mobilization. The plan shall include haul routes (On site, to the airport, gate access, and through the fence), public access, security fencing, batch plant locations, stockpile locations and dust control.

- C. Insurance and Bonds shall be purchased by the Contractor and Subcontractors in compliance with Article XI, *Insurance and Bonds* of the General Conditions, and modified in Division B, *Additional Requirements from Aviation Department, Insurance*.

D. Airside Safety and Security / Traffic Control

The airport is operated in strict compliance with Transportation Security Administration (TSA) and Federal Aviation Regulations (FAR), which prohibit unauthorized persons or vehicles in the Air Operations Area (AOA). Equipment and workmen will be restricted to the work area defined on the plans. Any violation by Contractor's personnel or sub-contractors will subject the contractor to penalties imposed by the TSA, FAA or San Antonio International Airport (SAIA).

The Contractor shall provide equipment, vehicles and manpower to administer all requirements of the Airport Construction Safety Plan (ACSP) as shown separately and the requirements shown below. The Contractor shall be responsible for the protection of the construction site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

The Contractor's responsibilities for work areas are as follows:

1. The Contractor shall be held responsible for controlling his employees, subcontractors, and their employees with regard to traffic movement.
2. The Contractor shall rebuild, repair, restore, and make good at his own expense all injuries or damages to any portion of the work occasioned by his use of these facilities before completion and acceptance of his work.
3. The Contractor shall submit to the Engineer in writing a detailed work plan for each construction phase. The work plan shall include, but not be limited to, temporary electrical facilities, installation sequence of underground electrical and storm sewer systems, paving sequence, installation sequence of electrical items, maintenance of airfield electrical and NAVAID power and control circuits. This plan shall be submitted 14 calendar days prior to the start of each construction phase. No work within the construction phase may commence until the phase work plan is approved.
4. The Contractor shall submit to the Engineer in writing a plan, by construction phase, for controlling construction equipment and vehicular movements in the Air Operations Area (AOA). This plan shall be submitted at the Pre-Construction Meeting. No work may commence until this plan is approved. The Plan must include material haul roads.
5. The Contractor shall provide a responsible Traffic Manager whose duty shall be to control all construction traffic on or near active runways, taxiways, haul roads, and highways. Paved surfaces shall be kept clear at all times and specifically must be kept free from all debris which might damage aircraft.

Access Control

Any time access is required to the Airport Restricted Areas the contractor shall be responsible for assuring that no breeches of airport security occur. Restricted areas are fenced and must remain fenced at all times. The gates will remain closed and locked or a guard will be provided at the Contractor's expense. The location of the entrance gate (Gate Guard) will be dependent on the contractors Construction plan and how the access for each phase of the project is chosen. The Contractor will furnish the guard with a roster of his personnel and ensure that each individual has adequate identification. The duplicate keys for each lock will be turned over to the airport authorities.

- No person shall enter the contractor worksite without authorization. Any person found within the worksite without proper identification as describe herein shall be considered unauthorized and shall be removed from the worksite.
- All persons authorized access to the worksite shall display a valid Airport ID badge or be under authorized escort.
- Persons authorized to provide escorts include airport staff and designated contractor supervisors. The number of personnel being escorted shall not exceed ten (10) non-badged

personnels; this includes vendors, subcontractors, visitors and part-time workers. **Failure to provide an escort can result in loss of escort privileges, fines, revocation of the security badge, or all three.**

Challenge Procedures: All personnel are responsible for challenging and reporting anyone in their work areas not displaying an Airport ID badge. Personnel shall contact Airport Operations and/or SA Police Department and detain person(s) if safe to do so.

AIRPORT SAFETY REQUIREMENTS

Material Safety Data sheets:

Subcontractors are required to bring copies of MSDSs for all hazardous chemicals brought onto the site.

- These will be retained by the MSDS coordinator and will be accessible to all employees.

Each subcontractor must bring its specific Hazardous Communication Program and MSDSs in a binder labeled with the contractors name and identified as a Hazardous Communication Program.

- Upon leaving the job site and the removal of all hazardous materials, the binder will be returned to the subcontractors

Operating Construction Vehicles on the Airport

No vehicle shall enter the contractor worksite unless the following conditions are met:

- The driver is authorized to access the worksite (in possession of valid security badge with a driver endorsement).
- The driver possesses a valid driver's license.
- The vehicle is properly marked with the company name.
- Vehicle is marked with beacon or checkered flag or under escort.

Prohibited Vehicles

The use of motorcycles, bicycles, two-wheeled motor scooters and privately owned vehicles within the worksite is strictly prohibited.

Vehicle Condition

Vehicles must be in good mechanical condition with operational lights, horn, brakes, and clear visibility from the driver's seat. Trailers and semi-trailers must be equipped with proper brakes so that when disengaged from a towing vehicle, neither aircraft engine blast nor wind will cause them to become free rolling.

Compliance

All traffic within the Airport Restricted Area and/or contractor worksite must comply with any lawful order, signal or direction of any Airport employee. When such traffic is controlled by signs or pavement markings, such symbols shall be obeyed, unless otherwise directed by an officer or agent of the Airport.

Night or Low Visibility Operations

All vehicle headlights, taillights, and running or clearance lights shall be in operational condition. Headlights shall be used at all times.

Construction Vehicle and Equipment Markings

All construction equipment and vehicles shall have flashing amber lights, mounted at the highest point, during the nighttime and a 3' x 3' orange and white checkered flag or a flashing amber beacon during the daytime. All vehicles and equipment on the construction site shall have company designations visibly displayed. No personal vehicles will be allowed in the work area. All construction vehicles and equipment must have the company name and/or logo and vehicle number at least four (4) inches in height on each side of the vehicle.

Operation of Vehicles

No vehicle shall operate within the Airport Restricted Area:

- unless operated by an individual in possession of a valid Airport Identification Badge with a drivers endorsement or, under the direct escort of someone who is.
 - In a careless or negligent manner.
 - With disregard of the rights and safety of others.
 - At a speed or in a way which endangers persons or property.
 - While the driver is under the influence of drugs or alcohol.
- If such vehicle is loaded or maintained as to endanger persons or property.

Speed Limits

The speed limit on the perimeter roads is 25 miles per hour. The speed limit on the haul route is 15 miles per hour.

Vehicle Accidents

Each operator of a motor vehicle involved in an accident on the airport that results in damage to property or personal injury shall first contact 9-1-1 and then report it fully to the Airport Operations Department as soon as possible after the accident. The report must include the name and address of the person reporting. Copies of reports taken by City are acceptable for incidents that occur in the public areas of the airport.

Use of Crossing Guards

For construction that requires personnel, vehicles, and equipment to cross active taxiways/runways or other areas deemed appropriate by Airport Operations, the contractor shall provide crossing guards to prohibit the unauthorized crossing of an active taxiway.

- Each crossing guard shall have and properly display a valid airport issued security badge.
- Each crossing guard is required to undergo training. This training is provided by Airport Operations.
- A crossing guard shall be provided for **both** sides of a crossing point unless otherwise specified by Airport Operations.
- Each crossing guard shall have two-way radio communication with the Air Traffic Control Tower via aviation band radio provided by the contractor.
- Each crossing guard shall be properly equipped: Hand held stop sign, safety vest, and hearing protection.

Hearing Protection

Contractor personnel working on or adjacent to the AOA are encouraged to wear hearing protection.

Worker Injuries

In the event of a serious injury requiring medical attention call **911**. If called from a cell phone, tell the emergency operator to connect to the City of Mesa Emergency Dispatch, otherwise the call will

be routed to Maricopa County Dispatch and that will delay emergency response. All injuries must also be reported to Airport Operations as soon as possible.

After Hours Contacts

The Contractor shall submit to the Engineer a list of personnel who can be contacted 24 hours a day, seven (7) days a week and can respond in a reasonable time frame regarding any possible emergency on the work site. The list must include names, job title and phone numbers.

Daily Site Inspections

Prior to the Contractor leaving the worksite for the day, an inspection of the site shall be completed. All discrepancies noted in the inspection must be corrected to the satisfaction of the Engineer prior to the Contractor leaving the worksite.

Deliveries

All deliveries for the contractor shall be received by the contractor. Deliveries will not be accepted by anyone other than the contractor. The Airport nor its authorized representatives will not accept or be responsible for deliveries.

Taxiway and Runway Closures

Taxiway and runway closures require a minimum of:

- Prior notification and coordination in accordance with the contract documents.
- Closure requests shall factor in time for unanticipated events such as weather and equipment malfunction.
- Movement area closure schedules must be met. The Contractor shall advise the Engineer immediately of any need to extend a closure.
- Failure to meet a closure schedule may result in fines.
- Barricade lights must be red in color and either steady burn or flashing.
- Permanently closed runways require the obliteration of threshold markings, designation markings and touchdown zone markings. A Lighted 'X' shall be placed at each runway end on top of the designation numbers or at the locations shown on the plans.

Haul Routes

- Contractors are required to mark haul routes with barricades, traffic cones, signage, and light stanchions prior to the start of work. Both sides of the haul route shall be delineated.
- The haul route must be marked with red, steady burn or flashing omni-directional lights if work is schedule between sunset and sunrise.
- The contractor will monitor the haul route on a daily basis to ensure all posted markings, signs, and delineators are in place.
- Placards will be issued to transient haul trucks (i.e. concrete) upon entry into the Restricted Area by the gate guard.

Cranes or Mobilized Equipment

All activities involving cranes or mobilized vehicles exceeding 20 feet in height on or near the AOA require 48-hour advance coordination with Airport Operations. The following information is required:

- Location of equipment
- Maximum extendable height
- Duration of use
- Daily hours of operation
- Whether or not the crane can be lowered when not in use

Equipment must be lowered to its stowed height when not in use or as otherwise directed. The **highest point** of each piece of equipment shall be marked by a 3' x 3' orange and white checkered flag. At night and during periods of low visibility, the highest point of the crane must be marked by a red obstruction light. Crews must be prepared to remove equipment promptly if so directed.

Runway Safety Areas

Construction within the following areas is prohibited, unless required by the contract documents and is subject to approval of the Engineer.

- Within 250 feet parallel to a runway centerline
- Within 160 feet parallel to a taxiway centerline
- Within 1000 feet of the end of an active runway

Staging Area

All contractor materials, equipment and supplies shall be within the contractor's designated staging area. All staging areas shall be marked, debris boxes covered and area kept neat and clean of debris. For equipment that must remain in the work area, the following conditions must be met:

- Be located outside of the runway/taxiway safety and obstruction free areas.
- Be marked with lighted barricades around the equipment perimeter with a spacing of no more than 10 feet.
- Be coordinated at least 48 hours in advance with the Engineer.
- The highest point of the equipment marked and lit with a red flashing/steady burning omni-directional obstruction light.

Barricades and Lighting

The perimeters of the actual work areas, all uneven surfaces, mounds and excavations shall be adequately barricaded with low level barricades and/or Type II barricades (Outside of the TOFA) and lighted with omni-directional flashing red lights to prevent intrusion by taxiing aircraft, equipment and vehicles. Low profile barricades shall be supplemented with flashing high intensity red lights and two (2) orange flags at least 20" x 20" square and made and installed so that they are always in the extended position and properly oriented. Low level barricades shall be orange and white in color and shall be eight (8) feet in length and ten (10) inches in height. All cones and other marking devices must be lighted or equipped with reflectors during periods of darkness as directed by Airport Operations.

All barricades and cones must be maintained and kept in proper working order by the Contractor. All burnt out lights or inoperative batteries must be replaced immediately. Barricades and cones must remain upright at all times.

The placement of sandbags on barricades may be required in situations of adverse weather. In addition, the contractor must keep an adequate supply of extra barricades, lights and batteries on

site. Escorts for barricade maintenance must be provided by the contractor or coordinated in advance with Airport Operations.

Only red, battery powered, omni-directional lights are acceptable within the Restricted Area of the airport.

Trenches and Excavations

Contractors shall close trenches located within active safety areas at the end of each workday. No open trenches or excavations will be allowed within the following active safety areas without prior coordination and approval with the Engineer:

- Within 250 feet parallel to a runway centerline (trenches/excavations within 200 feet of a runway centerline require a runway closure which are subject to strict controls).
- Within 110 feet parallel to a taxiway centerline.
- Within 1000 feet of the end of a runway.
- Open trenches not to exceed 500 feet in length at any one time.
- Spoils from excavations are to be placed on the runway/taxiway side that is closest to the trench.
- Spoils length not to exceed 500 feet in length at any one time.
- Spoil height is not to exceed 4 feet or any height that would cause a visual obstruction.
- Spoils not returned to the trench or removed from the worksite are to be properly marked with lighted barricades with a spacing of no more than 10' or that to properly delineate the trench.

Stockpiled Material

Stockpiled materials are allowed only within the contractor's designated staging areas.

- Remove daily all stockpiled material from within aircraft movement areas, unless otherwise directed by the Engineer.
- No excavated or stored materials may remain within active runway or taxiway safety areas and object free zones.
- Stockpiled material may be located within the Air Operations Area only upon prior coordination and approval of the Engineer.

Workers with Airport ID Badges

Employees with a valid Airport ID badge are authorized to proceed into the Restricted Area. Advise the employee to remain on the designated haul route to their intended area. Airport ID badges must be worn on the outermost garment once inside the Restricted Area, including contractor worksite.

Workers without Airport ID Badges

Employees without a valid Airport ID badge must first check in with the security guard and be properly escorted inside the Restricted Area to their intended area. The gate guard shall log down the date, employee name and company. Advise the employee to wait at the gate until the escort arrives.

Deliveries

Delivery trucks are not required to obtain an Airport ID badge but must be properly escorted in order to proceed inside the Restricted Area to their intended area. The gate guard shall log down the date, driver name, and company. Advise the driver to wait at the gate until the escort arrives.

Haul Trucks

Transient haul truck drivers are not required to obtain an Airport ID badge but are required to check in with the contractor security guard. The driver shall be issued an orange/white checkered flag to be mounted on the highest point of the truck; and shall be returned to the security guard upon check out. Advise the driver to remain on the marked haul route and follow the appropriate signs to the intended work area. At no time shall a driver unfamiliar with the worksite be allowed to deviate from the marked haul route.

Weapons

No person, except a peace officer, authorized air carrier employee, airport employee or a member of an armed force of the United States on official duty, shall carry any weapon, explosive, or inflammable material on or about his person, openly or concealed, in the Restricted Area of the airport without the written permission of Airport Operations. No person shall furnish, give, sell, or trade a weapon on airport property.

Contractor Responsibilities

- The contractor must maintain and provide to the Engineer a log detailing the contract number, the airfield access point used, and all authorized and anticipated subcontractors and suppliers that will be requiring entry.
- The contractor must furnish guards with a sufficient number of flags for transient vehicles such as concrete or asphalt trucks entering the Restricted Area.
- The contractor must furnish guards a means of securing the access point should the guard have to leave the area in an emergency.

100.2. MEASUREMENT:

- A. Mobilization/Demobilization will be measured for payment by the lump sum as a single complete unit of work.
- B. Contractor Staging Area will be measured as a single complete unit of work.
- C. Insurance and Bond will be measured for payment by the lump sum as a single complete unit of work.
- D. Airside Safety and Security / Traffic Control will be measured for payment by the lump sum as a single complete unit of work.

100.3. PAYMENT:

- A. Mobilization/Demobilization
Payment for the performance of the Mobilization/Demobilization work as above specified will be made as partial payments as described below for the item Mobilization/Demobilization.
 - A. Payment will be made upon verification of documented expenditures for plant and facility setup. The combined amount for all these facilities will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.
 - B. When 1% of the adjusted Contract amount for construction Items is earned, 50% of the mobilization lump sum bid or 5% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.

- C. When 5% of the adjusted Contract amount for construction Items is earned, 75% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under the Item will be deducted from this amount.
- D. When 10% of the adjusted Contract amount for construction Items is earned, 90% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.
- E. Payment for the remainder of the lump sum bid for "Mobilization" will be made on the next estimate cycle after the initial retainage estimate or at final acceptance for projects without retainage.

Payment for Mobilization/Demobilization shall not exceed eight (8) percent of the total bid price for the base bid and shall not exceed eight (8) percent for the total of any of the additive alternate bid amounts.

- C. Contractor Staging Area
Payment for the providing a Contractor Staging Area **Off Site** shall be made as an not-to-exceed allowance. This allowance shall be full compensation for leasing, permitting, site preparation, operation, demobilization, utility services and for all labor, equipment, tools, and incidentals necessary to complete this item.

Partial payments will be made uniformly over the contract time, provided that the work site under Contractor Staging Area is maintained satisfactorily to the approval of the Airport and Engineer. The Contractor shall provide all lease payments, invoices, purchase orders, receipts, time sheets, payroll records, subcontractor agreements, and supplier agreements as documentation for payment against the allowance.

If the Contractor is allowed to use an on-site airport staging area, no allowance payment will be made for a Contractor Staging Area.

- D. Insurance and Bonds
Payment for Insurance and Bonds will be made upon presentation of a paid invoice for the payment bond, performance bond, and required insurance. The combined payment for bonds and insurance will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.

- E. Airside Safety and Security / Traffic Control
Payment for Airside Safety and Security / Traffic Control shall include full compensation for furnishing and administering all requirements of the Airport Construction Safety Plan (ACSP) and furnishing all labor, materials, **four (4) Lighted Runway X's**, vehicle/personnel escorts, power vacuum sweepers, furnishing, placement and removal of all temporary airside traffic control (low level barricades and safety fence), vehicle and equipment markings, security badges and training for all construction personnel, equipment, flagmen, cell phones, and incidentals to safely control construction traffic for the San Antonio International Airport.

Partial payments will be made uniformly over the contract time, provided that the work under Airside Safety and Security / Traffic Control is maintained satisfactorily to the approval of Airport Operations and the Engineer.

100.4. BID ITEM:

Payment will be made under:

- Item 100.1 Mobilization/Demobilization (maximum of 5%) - lump sum
- Item 100.2 Contractor Staging Area - per allowance
- Item 100.3 Insurance and Bonds - lump sum
- Item 100.4 Airside Safety and Security / Traffic Control - lump sum

END OF ITEM 100

ITEM 101

PREPARING RIGHT-OF-WAY

101.1. DESCRIPTION: *Prepare the right of way and designated easements for construction operations by removing and disposing of all obstructions when removal of such obstructions is not specifically shown on the plans to be paid by other Items.*

101.2. MATERIALS:

A. Obstructions. Obstructions shall be considered to include, but not limited to, remains of houses not completely removed by others, foundations, floor slabs, concrete, brick, lumber, plaster, cisterns, septic tanks, basements, abandoned utility pipes or conduits, equipment or other foundations, fences, retaining walls, outhouses, shacks, and all other debris as well as buried concrete slabs, curbs, gutters, driveways, and sidewalks.

This item shall also include the removal of trees, stumps, bushes, shrubs, brush, roots, vegetation, logs, rubbish, paved parking areas, miscellaneous stone, brick, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron and all debris, whether above or below ground, except live utility facilities.

It is the intent of this specification to provide for the removal and disposal of all obstructions to the new construction together with other objectionable materials not specifically provided for elsewhere by the plans and specifications.

B. Explosives. This item shall not govern for the demolition of buildings by the use of explosives. Such demolition work shall be governed by the use of a special specification controlling the work.

C. Fences. Unless shown otherwise on the plans, all fences along the right-of-way which are damaged or removed temporarily by the Contractor shall be replaced by the Contractor to an equal or better condition at no additional cost to the City.

D. Hazardous Materials. If the Contractor encounters hazardous substances, industrial waste, other environmental pollutants, underground storage tanks, or conditions conducive to environmental damage, Contractor shall immediately stop work in the area affected and report the condition to the Owner's representative in writing. Contractor shall not be responsible for or required to conduct any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work of any kind or nature (the "remedial work") under any applicable level, state or federal law, regulation or ordinance, or any judicial order. If the Contractor agrees in writing to commence and/or prosecute some or all of the remedial work, all costs and expenses, to include any extension of the contract time, of such remedial work shall be paid by Owner to Contractor as additional compensation.

101.3. EQUIPMENT: Provide applicable equipment to conduct work as described in this specification or as specified on the plans.

101.4. CONSTRUCTION: Protect designated features on the right of way and prune trees and shrubs as directed. Do not park equipment, service equipment, store materials, or disturb the root area under the branches of trees designated for preservation. When shown on the

plans, treat cuts on trees with an approved tree wound dressing within 20 min. of making a pruning cut or otherwise causing damage to the tree. Follow all local and state regulations when burning. If burning of brush is approved, pile and burn at approved locations. When working in state or national forests or parks, coordinate work with state and federal authorities. Testing, removal, and disposal of hazardous materials will be in accordance with 101.2.D, "Hazardous Materials."

Clear areas shown on the plans of all obstructions, except those landscape features that are to be preserved. Such obstructions include but are not limited to those identified in 101.2.A, "Obstructions" and other items as specified on the plans. Remove vegetation and other landscape features not designated for preservation. Removal of live utility facilities is not included in this Item. Remove culverts, storm sewers, manholes, and inlets in proper sequence to maintain traffic and drainage.

Unless otherwise indicated on the plans, all underground obstructions shall be removed to the following depths:

- In areas receiving embankment, remove obstructions not designated for preservation to 2 ft. below natural ground.
- In areas to be excavated, remove obstructions to 2 ft. below the excavation level.
- In all other areas, remove obstructions to 1 ft. below natural ground.
- When allowed by the plans or directed, cut trees and stumps off to ground level.

Holes remaining after removal of all obstructions, objectionable materials, vegetation, etc. shall be backfilled and tamped and the entire area bladed, to prevent ponding of water and to positive provide drainage. Backfill materials deemed unacceptable by the Engineer shall be removed and replaced at no additional cost to the City. In areas that are to be immediately excavated, backfilling and blading may be eliminated if approved by the Engineer. Areas to be used as borrow sites and material sources shall have all obstructions, objectionable materials, vegetation, etc., removed to the complete extent necessary to prevent such objectionable matter from becoming mixed with the material to be used in the construction.

Where a conduit is shown to be replaced, it shall be removed in its entirety and all connections to the existing conduit shall be extended to the new line. Where an existing conduit is to be cut and plugged, the line shall be cut back not less than 2 feet and a plug of concrete not less than 2 feet long shall be poured and held in the end of the pipe or the plug may be accomplished by using a precast stopper grouted into place.

Material to be removed will be designated as "salvageable" or "non-salvageable" on the plans prior to bidding by the Contractor. All "salvageable" material will remain the property of the City and will be stored at the site as directed by the Engineer. All "non-salvageable" materials and debris removed shall become the property of the Contractor and shall be removed from the site and shall be disposed of properly and in accordance with local, state, and federal requirements.

All asphaltic material shall be deposited of or recycled at a facility authorized to accept the asphalt for such purposes.

Dispose of wells in accordance with TxDOT Item 103, "Disposal of Wells."

101.5. MEASUREMENT: “Preparing Right-of-Way” for new construction will be measured by the lump sum.

101.6. PAYMENT: This item will be paid for at the contract lump sum price bid for “Preparing Right- of-Way,” which price shall be full compensation for work herein specified, including the furnishing of all materials, equipment, tools, labor, and incidentals necessary to complete the work. The lump sum price will be pro-rated based on the number of phases in the project. A phase will be eligible for payment when excavation is completed for that phase.

101.7. BID ITEM:

Item 101.1 - Preparing Right-of-Way - lump sum

END OF ITEM 101

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ITEM 530

BARRICADES, SIGNS, AND TRAFFIC HANDLING

530.1. DESCRIPTION: *This item shall govern for providing, installing, moving, repairing, maintaining, cleaning and removing upon completion of work, all barricades, signs, cones, lights and other such type devices and of handling traffic as indicated on the plans or as directed by the Engineer.*

530.2. GUIDELINES FOR BARRICADING ON CITY RIGHT-OF-WAY: The barricade contractor must locally maintain sufficient materials in stock to accommodate three or more construction phases per project. These will include all applicable traffic control sign types, trucks, trailers, arrow boards, and all other traffic control devices assigned to the Contractors barricading operation.

The *Texas Manual on Uniform Traffic Control Devices (TMUTCD)*, Section 6A-6, requires the appropriate training for all personnel who are involved in the selection, placement, and maintenance of traffic control devices on construction projects. The City of San Antonio requires that all personnel associated with barricading operations and traffic handling possess certificates from either of the two groups listed in Table 1 below. Each certificate will be valid for four years.

**Table 1
Barricading Training**

| | |
|-----------------------------|--------------------------------------|
| Texas Engineering Extension | American Traffic Safety Service |
| Work Zone Traffic Control | Training Course for Worksite Traffic |

The Contractor shall have a minimum of one barricade supervisor and three persons who are responsible for construction work zone traffic control. These persons shall be based in the San Antonio metropolitan area and their sole tasks shall be implementing and maintaining construction work zone traffic control devices.

The Contractor shall have a commercial telephone answering service during non-working hours. The Contractor shall provide the City during working hours with an office telephone number, pager number, and cellular telephone number to contact the barricading supervisor. The contractor must be able to respond to any call within two hours. The barricading contractor or General Contractor must possess liability insurance in the minimum amount of one million dollars. A copy of the liability policy must be sent to the City Traffic Engineer for approval 48 hours prior to starting barricading operations.

The contractor shall comply with all standards set forth in the plan barricade detail sheets. One noncompliance letter issued by the City to the Contractor in regard to construction work zone traffic control, and not corrected within 48 hours, will be cause for delay of payment for this item.

If the general contractor elects to do his own barricading, he must comply with all the foregoing requirements. Additionally, a general contractor will be required to submit a traffic control plan (TCP) at least 72 hours in advance (excluding weekends and holidays) of starting work in each construction phase. Upon satisfactory evidence of competent barricading expertise, this requirement for a traffic control plan may be waived by the City Traffic Engineer.

- 530.3. EQUIPMENT:** Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.
- 530.4. CONSTRUCTION:** All barricades, signs, and other types of devices listed above shall conform to the requirements of the TMUTCD. It is the contractors responsibility to see that all traffic control devices are properly installed and maintained at the job site. If it is determined by the Traffic Engineering Representative that the traffic control devices do not conform to the established standards, or are incorrectly placed to protect the general public, the Traffic Engineer shall have the option to stop the work, at no expense to the City, until the situation is corrected by the Contractor. If it is determined that additional temporary traffic control devices, special directional devices, and/or business name signs are required, they will be provided by the contractor at no additional cost. As work progresses, the location of temporary traffic control devices will be adjusted and modified as necessary by the Contractor.

All retro reflective traffic control devices such as barricades, vertical panels, signs, etc., shall be maintained by cleaning, replacing or a combination thereof such that during darkness and rain, the retro reflective characteristics shall equal or exceed the retro reflective characteristics of the standard reflective panels in the Inspectors possession.

The contractor shall contact the City of San Antonio Traffic Operations Section prior to removing any traffic signs or traffic signals. Prior to completion of the contract and removal of barricades, all applicable permanent traffic signs and signals must be in place and functioning properly. All permanent signs or traffic control devices missing or damaged during construction shall be replaced at the contractors expense. Permanent pavement marking shall be applied prior to the opening of any street to traffic. Temporary short-term expendable pavement markings may be provided prior to application of permanent markings.

The contractor must maintain all streets open to through traffic by repairing trenches, potholes, etc., at no direct payment. The contractor shall provide reasonable access to residences and all businesses within all phases of the work, as well as providing suitable access accommodations for school children, pedestrians, garbage pick-up and mail delivery by the US Postal Service. Temporary pedestrian crossing will be determined in the field by the Police Department School Services Unit. Temporary pedestrian crossings shall be 4 feet wide by 4 inches thick asphalt treated base or asphaltic concrete and will be paid for under Item 206, Asphalt Treated Base or Item 205, Hot Mix Asphaltic Concrete Pavement, respectively.

When flagging is required by the plans or Traffic Control Plan, provide a Contractor representative who has been certified as a flagging instructor through courses offered by the Texas Engineering Extension Service, the American Traffic Safety Services Association, the National Safety Council, or other approved organizations. Provide the certificate indicating course completion when requested. This representative is responsible for training and assuring that all flaggers are qualified to perform flagging duties. A qualified flagger must be independently certified by one of the organizations listed above or trained by the Contractors certified flagging instructor. Provide the Engineer with a current list of qualified flaggers before beginning flagging activities. Use only flaggers on the qualified list.

Flaggers must be courteous and able to effectively communicate with the public. When directing traffic, flaggers must use standard attire, flags, signs, and signals and follow the flagging procedures set forth in the TMUTCD.

530.5. MEASUREMENT: This item will be not be measured be measured separately.

530.6. PAYMENT: This item will be not be paid for separately. All work for barricades, signs, and traffic handling shall be included in other pay items. No separate payment will be made for compensation for furnishing all labor, materials, supplies, equipment and incidentals necessary, but will be considered incidental to other project work items.

END OF ITEM 530

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ITEM 540

**TEMPORARY EROSION, SEDIMENTATION AND WATER POLLUTION PREVENTION
AND CONTROL**

540.1. DESCRIPTION: *This item shall govern the control measures necessary to prevent and control soil erosion, sedimentation and water pollution which may degrade receiving waters including rivers, streams, lakes, reservoirs, tidal water, groundwater and wetlands.*

Note: The control measures contained herein shall be installed and maintained throughout the construction contract and coordinated with the permanent or existing temporary pollution control features specified elsewhere on the plans and in the specifications to assure effective and continuous water pollution control throughout the construction and post construction period. These control measures shall not be used as a substitute for the permanent pollution control measures unless otherwise directed by the Engineer in writing. The controls may include sediment control fences, inlet protection, baled hay, rock filter dams, dikes, swales, sediment traps and basins, pipe slope drains, paved flumes, construction exits, temporary seeding, sodding, mulching, soil retention blankets or other structural or non-structural water pollution controls. This item does not apply to commercial operations.

540.2. MATERIALS: The items, estimated quantities and locations of the control measures are shown on the plans; however, the Engineer may increase or decrease the quantity of these items as the need arises. The materials will be shown on the plans and in this specification. The Engineer may allow other materials and work as the need arises and as approved in writing. Pollution control measures may be applicable to contractor operations outside the right of way where such work is necessary as a result of roadway related construction such as construction and haul roads, field offices, equipment and supply areas, and materials sources.

Unless otherwise shown on the plans, provide materials that meet the following requirements:

A. Rock Filter Dams.

1. Aggregate. Furnish aggregate with hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding acceptable to the Engineer. Provide the following:
 - Types 1, 2, and 4 Rock Filter Dams. Use 3 to 6 in. aggregate.
 - Type 3 Rock Filter Dams. Use 4 to 8 in. aggregate.
2. Wire. Provide minimum 20 gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:
 - a double-twisted, hexagonal weave with a nominal mesh opening of 2½ in. x 3¼ in.;
 - minimum 0.0866 in. steel wire for netting;
 - minimum 0.1063 in. steel wire for selvages and corners; and minimum 0.0866 in. for binding or tie wire.
3. Sandbag Material. Furnish sandbags meeting Section 540.2.I, Sandbags, except that any gradation of aggregate may be used to fill the sandbags.

- B. Temporary Pipe Slope Drains. Provide corrugated metal pipe, polyvinyl chloride (PVC) pipe, flexible tubing, watertight connection bands, grommet materials, prefabricated fittings, and flared entrance sections that conform to the plans. Recycled and other materials meeting these requirements are allowed if approved. Furnish concrete in accordance with Item 505, Concrete Riprap.
- C. Baled Hay. Provide hay bales weighing at least 50 lb., composed entirely of vegetable matter, measuring 30 in. or longer, and bound with wire, nylon, or polypropylene string.
- D. Temporary Paved Flumes. Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material that conforms to the plans. Provide rock or rubble with a minimum diameter of 6 in. and a maximum volume of ½ cu. ft. for the construction of energy dissipaters.
- E. Construction Exits. Provide materials that meet the details shown on the plans and this Section.
1. Rock Construction Exit. Provide crushed aggregate for long and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft, or flaky materials and organic and injurious matter. Use 4- to 8- in. rock for Type 1 and 2- to 4- in. rock for Type 3. Unless otherwise shown on the plans, provide a light weight (4 oz.) non-woven filter fabric below the ballast to prevent mud and sediment migration.
 2. Timber Construction Exit. Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers with nuts and bolts or lag bolts, of at least ½ in. diameter, unless otherwise shown on the plans or allowed. For short-term exits, provide plywood or pressed wafer board at least ½ in. thick.
 3. Foundation Course. Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the plans or directed.
- F. Embankment for Erosion Control. Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.
- G. Pipe. Provide pipe outlet material in accordance with TxDOT Standard Specification Item 556, Pipe Underdrains, and details shown on the plans.
- H. Construction Perimeter Fence.
1. Posts. Provide essentially straight wood or steel posts that are at least 60 in. long. Furnish soft wood posts with a minimum diameter of 3 in. or use 2 x 4 boards. Furnish hardwood posts with a minimum cross-section of 1½ x 1-1/5 in. Furnish T- or L-shaped steel posts with a minimum weight of 0.95 lb. per foot.
 2. Fence. Provide orange construction fencing as approved by the Engineer.

3. Fence Wire. Provide 14 gauge or larger galvanized smooth or twisted wire. Provide 16 gauge or larger tie wire.
 4. Flagging. Provide brightly-colored flagging that is fade-resistant and at least ¾ in. wide to provide maximum visibility both day and night.
 5. Staples. Provide staples with a crown at least ½ in. wide and legs at least ½ in. long.
 6. Used Materials. Previously used materials meeting the applicable requirements may be used if accepted by the Engineer.
- I. Sandbags. Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 oz. per square yard, a Mullen burst-strength exceeding 300 psi, and an ultraviolet stability exceeding 70%. Use natural coarse sand or manufactured sand meeting the gradation given in Table 1 to fill sandbags. Filled sandbags must be 24 to 30 in. long, 16 to 18 in. wide, and 6 to 8 in. thick.

Table 1
Sand Gradation

| Sieve # | Maximum Retained (% by Weight) |
|---------|--------------------------------|
| 4 | 3% |
| 100 | 80% |
| 200 | 95% |

- J. Temporary Sediment Control Fence. Provide a net-reinforced fence using woven geotextile fabric. Logos visible to the traveling public will not be allowed.
1. Fabric. Provide fabric materials in accordance with TxDOT DMS-6230, "Temporary Sediment Control Fence Fabric."
 2. Posts. Provide essentially straight wood or steel posts with a minimum length of 48 in., unless otherwise shown on the plans. Soft wood posts must be at least 3 in. in diameter or nominal 2 x 4 in. Hardwood posts must have a minimum cross-section of 1½ x 1½ in. T- or L-shaped steel posts must have a minimum weight of 0.95 lb. per foot.
 3. Net Reinforcement. Provide net reinforcement of at least 14 gauge galvanized welded wire mesh, with a maximum opening size of 2 x 4 in., at least 24 in. wide, unless otherwise shown on the plans.
 4. Staples. Provide staples with a crown at least ¾ in. wide and legs ½ in. long.
 5. Used Materials. Use recycled material meeting the applicable requirements if accepted by the Engineer.
- K. Curb Inlet Gravel Filters.
1. Gravel Filter Bags. Furnish gravel filter bags meeting Section 540.2.I, "Sandbags." Gravel bags shall be filled with ¾ inch gravel.

2. Concrete Masonry Units. Hollow, Non-Load-Bearing Concrete blocks of 1500-2000 psi, 28-day compressive strength concrete shall be used with dimensions of 8" x 6" x 6" width, height, and length, respectively.
3. Wood Blocks. Wolmanized treated 2" x 4" lumber with the length as per inlet size.

540.3. EQUIPMENT: Provide a backhoe, front end loader, blade, scraper, bulldozer, or other equipment as required when "Earthwork for Erosion Control" is specified on the plans as a bid item.

540.4. CONSTRUCTION: The contractor shall provide control measures to prevent or minimize the impact to receiving waters as required by the plans and/or as directed by the Engineer in writing.

A. Contractor Responsibilities.

1. SW3P. Implement the City's Storm Water Pollution Prevention Plan (SWP3) for the project site in accordance with the specific or general storm water permit requirements. Prevent water pollution from storm water associated with construction activity from entering any surface water or private property on or adjacent to the project site. The Contractor shall effectively prevent and control erosion and sedimentation on the site at the earliest practicable time as outlined in the approved schedule. Control measures, where applicable, will be implemented prior to the commencement of each construction operation or immediately after the area has been disturbed.
2. Preconstruction Submittals.
 - a. Operations on Right of Way. Prior to the start of construction, the Contractor shall submit to the Engineer, for approval, schedules for accomplishment of the pollution control measures in accordance with the Storm Water Pollution Prevention Plan (SW3P). A plan for the disposal of waste materials generated on the project site must be submitted for approval, also. The Contractor shall submit to the Engineer, for approval, the proposed SW3P for the industrial activities (such as hot mix plants, concrete batch plants, or material handling areas) on the right of way.
 - b. Operations off Right of Way. The Contractor shall provide the Engineer, for information purposes only, proposed methods of pollution control for Contractor operations in areas which are outside the right of way (such as construction and haul roads, field offices, equipment and supply areas, and material sources).

Pollution control measures for the Contractor's facilities off the right of way are not covered by the City's Environmental Protection Agency (EPA) NPDES general permit. The Contractor shall obtain his own Notice of Intent for the off-site operations. These pollution controls will not be measured for payment but shall be performed at the Contractor's expense.

B. General.

1. Phasing. Implement control measures in the area to be disturbed before beginning construction, or as directed. Limit the disturbance to the area shown on the plans or as directed. If, in the opinion of the Engineer, the Contractor cannot control soil erosion and sedimentation resulting from construction operations, the Engineer will limit the disturbed area to that which the Contractor is able to control. Minimize disturbance to vegetation.
2. Rainfall Events. A rain gauge shall be provided by the Contractor and located at the project site. Within 24 hours of a rainfall event of ½ inch or more as measured by the project rain gauge, the Contractor and Inspector will inspect the entire project to determine the condition of the control measures. Maintain control measures in accordance with Item 540.4.B.3, "Maintenance."
3. Maintenance. Correct ineffective control measures in accordance with this section. Implement additional controls as directed. Remove excavated material within the time requirements specified in the applicable storm water permit.

Following a rain event as described in Item 540.4.B.2, Rainfall Event," sediment will be removed and devices repaired as soon as practicable but no later than 7 days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment needed for repair of control measures.

In the event of continuous rainfall over a 24-hour period, or other circumstances that preclude equipment operation in the area, the Contractor will hand carry and install additional backup devices as determined by the Engineer. The Contractor will remove silt accumulations and deposit the spoils in an area approved by the Engineer as soon as practical. Any corrective action needed for the control measures will be accomplished in the sequence directed by the Engineer; however, areas adjacent to waterbodies shall generally have priority followed by devices protecting storm sewer inlets.

4. Stabilization. Stabilize disturbed areas where construction activities will be temporarily stopped, or construction becomes inactive, in accordance with the applicable storm water permit. Inactive construction areas are defined as areas in which no construction activity will occur for a period of 30 days or longer. Inactive construction areas which have been disturbed will require stabilization through the use of vegetation, mulch, erosion control matting or structural methods within 7 calendar days from the last construction activity in the area. At all times prior to stabilization, inactive construction areas shall be considered as active, disturbed construction area, contributing to the sediment loading at the site control systems. After stabilization, inactive construction areas will be considered undisturbed areas, eliminating the contribution of sediment to the erosion control devices.

5. Finished Work. Upon acceptance of vegetative cover, remove and dispose of all temporary control measures, temporary embankments, bridges, matting, falsework, piling, debris, or other obstructions placed during construction that are not a part of the finished work, or as directed. Soil retention blankets shall be removed only when, in the opinion of the Engineer, final permanent perennial seeding would be adversely affected by the presence of an existing soil retention blanket.

The project will not be accepted until a 70% density of existing adjacent undisturbed areas is obtained, unless otherwise shown on the plans. When shown on the plans, the Engineer may accept the project when adequate controls are in place that will control erosion, sedimentation, and water pollution until sufficient vegetative cover can be established.

6. Restricted Activities. Do not locate disposal areas, stockpiles, or haul roads in any wetland, water body, or streambed. Do not install temporary construction crossings in or across any water body without the prior approval of the appropriate resource agency and the Engineer. Restrict construction operations in any water body to the necessary areas as shown on the plans or applicable permit, or as directed. Use temporary bridges, timber mats, or other structurally sound and non-eroding material for stream crossings.

Provide protected storage area for paints, chemicals, solvents, and fertilizers at an approved location. Keep paints, chemicals, solvents, and fertilizers off bare ground and provide shelter for stored chemicals.

- C. Installation, Maintenance, and Removal Work. Perform work in accordance with the specific or general storm water permit. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until earthwork construction and permanent erosion control features are in place or the disturbed area has been adequately stabilized as determined by the Engineer. If a device ceases to function as intended, repair or replace the device or portions thereof as necessary. Remove sediment, debris, and litter. When approved, sediments may be disposed of within embankments, or in the right of way in areas where the material will not contribute to further siltation. Dispose of removed material in accordance with federal, state, and local regulations. Remove devices upon approval or when directed. Upon removal, finish-grade and dress the area. Stabilize disturbed areas in accordance with the permit, and as shown on the plans or directed. The Contractor retains ownership of stockpiled material and must remove it from the project when new installations or replacements are no longer required.

1. Rock Filter Dams for Erosion Control. Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams. Place sandbags as a foundation when required or at the Contractor's option. For Types 1, 2, 3, and 5, place the aggregate to the lines, height, and slopes specified, without undue voids. For Types 2 and 3, place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side with wire ties, or hog rings, or as directed. Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed. Construct filter dams according to the following criteria, unless otherwise shown on the plans:

a. Type 1 (Non-reinforced).

(1) Height. At least 18 in. measured vertically from existing ground to top of filter dam.

(2) Top Width. At least 2 ft.

(3) Slopes. At most 2:1.

b. Type 2 (Reinforced).

(1) Height. At least 18 in. measured vertically from existing ground to top of filter dam.

(2) Top Width. At least 2 ft.

(3) Slopes. At most 2:1.

c. Type 3 (Reinforced).

(1) Height. At least 36 in. measured vertically from existing ground to top of filter dam.

(2) Top Width. At least 2 ft.

(3) Slopes. At most 2:1.

d. Type 4 (Sack Gabions). Unfold sack gabions and smooth out kinks and bends. For vertical filling, connect the sides by lacing in a single loop–double loop pattern on 4-to 5-in. spacing. At one end, pull the end lacing rod until tight, wrap around the end, and twist 4 times. At the filling end, fill with stone, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires 4 times. For horizontal filling, place sack flat in a filling trough, fill with stone, and connect sides and secure ends as described above. Lift and place without damaging the gabion. Shape sack gabions to existing contours.

e. Type 5. Provide rock filter dams as shown on the plans.

2. Temporary Pipe Slope Drains. Install pipe with a slope as shown on the plans or as directed. Construct embankment for the drainage system in 8-in. lifts to the required elevations. Hand-tamp the soil around and under the entrance section to the top of the embankment as shown on the plans or as directed. Form the top of the embankment or earth dike over the pipe slope drain at least 1 ft. higher than the top of the inlet pipe at all points. Secure the pipe with hold-downs or hold-down grommets spaced a maximum of 10 ft. on center. Construct the energy dissipaters or sediment traps as shown on the plans or as directed. Construct the sediment trap using concrete in accordance with Item 505, “Concrete Riprap,” when designated on the plans. Rubble riprap in accordance with TxDOT Standard Specification Item 432, “Riprap” may also be used when designated on the plans or as directed by the Engineer.
3. Baled Hay for Erosion and Sedimentation Control. Install hay bales at locations shown on the plans by embedding in the soil at least 4 in. and, where possible, approximately ½ the height of the bale, or as directed. Fill gaps between bales with hay.

4. Temporary Paved Flumes. Construct paved flumes as shown on the plans or as directed. Provide excavation and embankment (including compaction of the subgrade) of material to the dimensions shown on the plans, unless otherwise indicated. Install a rock or rubble riprap energy dissipater, constructed from the materials specified above to a minimum depth of 9 in. at the flume outlet to the limits shown on the plans or as directed.
5. Construction Exits. When tracking conditions exist, prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits. Construct exits for either long or short-term use.
 - a. Long-Term. Place the exit over a foundation course, if necessary. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the plans or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.
 - (1) Type 1. Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.
 - (2) Type 2. Construct using railroad ties and timbers as shown on the plans or as directed.
 - b. Short-Term.
 - (1) Type 3. Construct using crushed aggregate, plywood, or wafer board. This type of exit may be used for daily operations where long-term exits are not practical.
 - (2) Type 4. Construct as shown on the plans or as directed.
6. Earthwork for Erosion and Sediment Control. Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.
 - a. Excavation and Embankment for Erosion Control Features. Place earth dikes, swales or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover. Place swales and dikes at other locations as shown on the plans or as directed to prevent runoff spillover or to divert runoff. Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides. Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the plans or as directed. Where required, create a sediment basin providing 3,600 cu. ft. of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at one time, not including offsite areas.
 - b. Excavation of Sediment and Debris. Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.

7. Construction Perimeter Fence. Construct, align, and locate fencing as shown on the plans or as directed.
 - a. Installation of Posts. Embed posts 18 in. deep or adequately anchor in rock, with a spacing of 8 to 10 ft.
 - b. Wire Attachment. Attach the top wire to the posts at least 3 ft. from the ground. Attach the lower wire midway between the ground and the top wire.
 - c. Flag Attachment. Attach flagging to both wire strands midway between each post. Use flagging at least 18 in. long. Tie flagging to the wire using a square knot.

8. Sandbags for Erosion Control. Construct a berm or dam of sandbags that will intercept sediment-laden storm water runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Fill each bag with sand so that at least the top 6 in. of the bag is unfilled to allow for proper tying of the open end. Place the sandbags with their tied ends in the same direction. Offset subsequent rows of sandbags ½ the length of the preceding row. Place a single layer of sandbags downstream as a secondary debris trap. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.

9. Temporary Sediment-Control Fence. Provide temporary sediment-control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion-control measures used to control sediment in areas of higher flow. Install the fence as shown on the plans, as specified in this Section, or as directed.
 - a. Installation of Posts. Embed posts at least 18 in. deep, or adequately anchor, if in rock, with a spacing of 6 to 8 ft. and install on a slight angle toward the run-off source.
 - b. Fabric Anchoring. Dig trenches along the uphill side of the fence to anchor 6 to 8 in. of fabric. Provide a minimum trench cross-section of 6 x 6 in. Place the fabric against the side of the trench and align approximately 2 in of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.
 - c. Fabric and Net Reinforcement Attachment. Unless otherwise shown under the plans, attach the reinforcement to wooden posts with staples, or to steel posts with T- clips, in at least 4 places equally spaced. Sewn vertical pockets may be used to attach reinforcement to end posts. Fasten the fabric to the top strand of reinforcement by hog rings or cord every 15 in. or less. **Fabric and Net Reinforcement must be cleaned or replaced if becomes ineffective (at the sole discretion of the airport or engineer).**

- d. Fabric and Net Splices. Locate splices at a fence post with a minimum lap of 6 in. attached in at least 6 places equally spaced, unless otherwise shown under the plans. Do not locate splices in concentrated flow areas. Requirements for installation of used temporary sediment control fence include the following:
- fabric with minimal or no visible signs of biodegradation (weak fibers),
 - fabric without excessive patching (more than 1 patch every 15 to 20 ft.),
 - posts without bends, and
 - backing without holes.

10. Curb Inlet Gravel Filter.

- a. Installation. Install the curb inlet gravel filters in the following manner:
- (1) Place the 2" x 4" treated lumber in front of and parallel with the opening of the inlet.
 - (2) Place the Concrete Masonry Units (CMUs) around the inlet, to be protected, in front of the 2" x 4" lumber, with the openings of the CMUs facing the inlet.
 - (3) Surround the CMUs with gravel bags, making certain that there are no gaps are evident between the gravel bags.
- b. Sediment Control. When the accumulated sediment deposit reaches a depth of approximately 6 inches, it shall be removed and disposed of at approved sites in a manner that will not contribute to additional siltation. If the structure ceases to function as intended, the Engineer may direct that the Filter bag be replaced. Such replacement will not be measured for payment. Torn or punctured bags shall be replaced with a new Filter bag.

540.5 MEASUREMENT: If the Contractor is required to install temporary erosion, sediment and water pollution control measures due to his negligence, carelessness, lack of maintenance, or failure to install permanent controls as a part of the work as scheduled, and measures are ordered in writing by the Engineer, such work shall not be measured for payment, but shall be performed at the Contractor's expense.

In case of failure on the part of the Contractor to prevent and control soil erosion, sedimentation and water pollution which may degrade receiving water, the Engineer reserves the right to employ outside assistance or to use City forces to provide the necessary corrective measures. All costs including engineering costs will be deducted from any moneys due or to become due to the Contractor.

When the need for control measures cannot be attributed to the contractor's negligence, carelessness, lack of maintenance or failure to install permanent water pollution control measures and these measures are shown on the plans and/or directed by the Engineer, these measures shall be measured and paid for in accordance with contract bid items shown under this section.

- A. Rock Filter Dams. Installation or removal of rock filter dams will be measured by the foot or by the cubic yard. The measured volume will include sandbags, when used.
 1. Linear Measurement. When rock filter dams are measured by the foot, measurement will be along the centerline of the top of the dam.
 2. Volume Measurement. When rock filter dams are measured by the cubic yard, measurement will be based on the volume of rock computed by the method of average end areas.
 - a. Installation. Measurement will be made in final position.
 - b. Removal. Measurement will be made at the point of removal.
- B. Temporary Pipe Slope Drains. Temporary pipe slope drains will be measured by the foot.
- C. Baled Hay. Baled hay will be measured by each bale.
- D. Temporary Paved Flumes. Temporary paved flumes will be measured by the square yard of surface area. The measured area will include the energy dissipater at the flume outlet.
- E. Construction Exits. Construction exits will be measured by the square yard of surface area.
- F. Earthwork for Erosion and Sediment Control. Earthwork for erosion and sediment control will not be measured directly but will be considered subsidiary to this or other pertinent items.
- G. Construction Perimeter Fence. Construction perimeter fence will be measured by the foot.
- H. Sandbags for Erosion Control. Sandbags will be measured as each sandbag or by the foot along the top of sandbag berms or dams.
- I. Temporary Sediment-Control Fence. Temporary sediment-control fence will be measured by the foot.
- J. Curb Inlet Gravel Filter. Curb inlet gravel filter will be measured by the linear foot, as measured on the centerline of the gravel bags installed.

540.6. PAYMENT: All of the following will not be paid for directly but are subsidiary to the pertinent BID ITEM shown below:

- erosion-control measures for Contractor project-specific locations (PSLs) inside and outside the right of way (such as construction and haul roads, field offices, equipment and supply areas, plants, and material sources);
- removal of litter;
- repair to devices and features damaged by Contractor operations;
- added measures and maintenance needed due to negligence, carelessness, lack of maintenance, and failure to install permanent controls;
- removal and reinstallation of devices and features needed for the convenience of the Contractor;
- finish grading and dressing upon removal of the device; and

- minor adjustments including but not limited to plumbing posts, reattaching fabric, minor grading to maintain slopes on an erosion embankment feature, or moving small numbers of sandbags.

The Contractor will be reimbursed for maintenance, repair, or reinstallation of devices and features when the need for additional control measures cannot be attributed to the above, as determined by the Engineer. Stabilization of disturbed areas will be paid for under pertinent Items. Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly but is subsidiary to the excavation and embankment under this Item.

Pollution control measures outside the right of way will not be measured for payment but shall be performed at the Contractor's expense.

Control measures as shown on the plans will be paid for in accordance with applicable bid items as shown below:

- A. Rock Filter Dams. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows:
1. Installation. Installation will be paid for as "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.
 2. Removal. Removal will be paid for as "Rock Filter Dams (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

When the Engineer directs that the rock filter dam installation or portions thereof be replaced, payment will be made at the unit price bid for "Rock Filter Dams (Remove)" and for "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals

- B. Temporary Pipe Slope Drains. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Pipe Slope Drains" of the size specified. This price is full compensation for furnishing materials, removal and disposal, furnishing and operating equipment, labor, tools, and incidentals.

Removal of temporary pipe slope drains will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the pipe slope drain installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Pipe Slope Drains" of the size specified, which is full compensation for the removal and reinstallation of the pipe drain.

Earthwork required for the pipe slope drain installation, including construction of the sediment trap, will be measured and paid for under Section 540.5.F, "Earthwork for Erosion and Sediment Control."

- C. Baled Hay. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Baled Hay." This price is full compensation for furnishing and placing bales, excavating trenches, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the baled hay installation (or portions thereof) be replaced, payment will be made at the unit price bid for "Baled Hay," which is full compensation for removal and reinstallation of the baled hay.

- D. Temporary Paved Flumes. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Paved Flume (Install)" or "Temporary Paved Flume (Remove)." This price is full compensation for furnishing and placing materials, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the paved flume installation or portions thereof be replaced, payment will be made at the unit prices bid for "Temporary Paved Flume (Remove)" and "Temporary Paved Flume (Install)." These prices are full compensation for the removal and replacement of the paved flume and for equipment, labor, tools, and incidentals.

Earthwork required for the paved flume installation, including construction of a sediment trap will be considered subsidiary to this item and will not be measured or paid for directly.

- E. Construction Exits. Contractor-required construction exits from off right-of-way locations or on-right of way PSLs will not be paid for directly but are subsidiary to pertinent Items.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" for construction exits needed on right-of-way access to work areas required by the Department will be paid for at the unit price bid for "Construction Exits (Install)" of the type specified or "Construction Exits (Remove)." This price is full compensation for furnishing and placing materials, excavating, removal and disposal, cleaning vehicles, labor, tools, and incidentals.

When the Engineer directs that a construction exit or portion thereof be removed and replaced, payment will be made at the unit prices bid for "Construction Exit (Remove)" and "Construction Exit (Install)" of the type specified. These prices are full compensation for the removal and replacement of the construction exit and for equipment, labor, tools, and incidentals. Construction of sediment traps used in conjunction with the construction exit will be considered subsidiary to this item and will not be measured or paid for directly.

- F. Earthwork for Erosion and Sediment Control. The work performed and materials furnished in accordance with this Item will not be paid for directly but is subsidiary to pertinent Items unless otherwise shown on the plans.

Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

- G. Construction Perimeter Fence. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Construction Perimeter Fence." This price is full compensation for furnishing and placing the fence; digging, fence posts, wire, and flagging; removal and disposal; and materials, equipment, labor, tools, and incidentals.

Removal of construction perimeter fence will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the perimeter fence installation or portions thereof be removed and replaced, payment will be made at the unit price bid for "Construction Perimeter Fence," which is full compensation for the removal and reinstallation of the construction perimeter fence.

- H. Sandbags for Erosion Control. Sandbags will be paid for at the unit price bid for "Sandbags for Erosion Control" (of the height specified when measurement is by the foot). This price is full compensation for materials, placing sandbags, removal and disposal, equipment, labor, tools, and incidentals.

Removal of sandbags will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the sandbag installation or portions thereof be replaced, payment will be made at the unit price bid for "Sandbags for Erosion Control," which is full compensation for the reinstallation of the sandbags.

- I. Temporary Sediment-Control Fence. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Sediment-Control Fence." This price is full compensation for furnishing and placing the fence; trenching, fence posts, fabric and backfill; removal and disposal; and equipment, labor, tools, and incidentals.

Removal of temporary sediment-control fence will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the temporary sedimentation control fence installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Sediment-Control Fence," which is full compensation for the removal and reinstallation of the temporary sediment-control fence.

- J. Curb Inlet Gravel Filter. The work performed and the materials furnished as specified herein, measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "Curb Inlet Gravel Filter," which payment shall be full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work as specified, including maintaining and replacing the gravel bags as required by these specifications, removal of accumulated silt, and removal and proper disposal of the "Curb Inlet Gravel Filter" upon completion of site stabilization.

540.7. BID ITEM:

Item 540.1 - Storm Water Pollution Prevention Plan - per lump sum

END OF ITEM 540

Update: February 2010

THE FOLLOWING ITEMS ARE SPECIAL PROVISIONS TO
THE CITY OF SAN ANTONIO
STANDARD SPECIFICATIONS FOR CONSTRUCTION
DATED JUNE 2008

1. Item 700 Project Schedules.....7 Pages

General

1. None

Standard Specifications

1. Delete Item 700 - Cost Loaded Schedules (*dated June 2008*) in its entirety and replace with Item 700 – Project Schedules (*dated February 2010*) shown on the attached document.

ITEM 700
✦
PROJECT SCHEDULES

This item shall govern the creation, maintenance, and delivery of Critical Path Method (CPM) project schedules.

CRITICAL PATH METHOD PROJECT SCHEDULE

The Contractor shall create and maintain a Critical Path Method (CPM) Project Schedule showing the manner of execution of work that the contractor intends to follow in order to complete the contract within the allotted time. The project schedule shall employ computerized CPM for the planning, scheduling and reporting of the work as described in this specification. The CPM project schedule shall be prepared using the Precedence Diagram Method (PDM). The Contractor shall create and maintain the schedule using Primavera Project Manager 5.x or above or Primavera Contractor 4.1 or above. For construction contracts under \$300K and project durations 90 days or less, the project schedule can be created and maintained in Microsoft Project software. The observance of the requirements herein is an essential part of the work to be done under the contract. No direct compensation will be allowed for fulfilling these requirements, as such work is considered subsidiary to the various bid items of the contract.

PERSONNEL

The Contractor shall provide an individual, referred to hereafter as the Scheduler, to create and maintain the Project Schedule. The Scheduler shall be proficient in Critical Path Method (CPM) analysis as demonstrated through certification from Project Management Institute (PMI), Association for the Advancement of Cost Engineering (AACE) or possess sufficient experience to be

able to perform required tasks on the specified software and be able to prepare and interpret reports from the software. The Scheduler shall be made available for discussion or meetings when requested by the City.

PROJECT SCHEDULE

1. GENERAL:

At least twenty (20) calendar days prior to the pre-construction conference, the Contractor shall submit a Project Schedule, which shall show the sequence and interdependence of activities required for complete performance of the work. All schedule submittals shall be in the electronic form to include PDF plots of the schedule, a PDF plot defining the Critical Path and two week look-ahead, and include the native Primavera file format. The Contractor shall submit the schedule to the Web-portal and Project Manager via electronic mail, CD-Rom, floppy disc, or any other electronic media acceptable to the City. The City will review the Project Schedule within twenty (20) calendar days for compliance with the specifications and notify the Contractor at the pre-construction conference of its acceptability. No work shall begin until the City has accepted the Project Schedule.

2. SEQUENCE:

The Project Schedule shall show the sequence and interdependence of activities required for complete performance of the work. The Contractor shall be responsible for assuring all work sequences are logical and show a coordinated plan of the work. The purpose of

the City requiring the Project Schedule shall be to:

- a. Ensure adequate planning during the execution and progress of the work in accordance with the allowable number of calendar days and all milestones.
- b. Assure coordination of the efforts of the Contractor, City, Utilities and others that may be involved in the project and that activities are included in the schedule highlighting coordination points with others,
- c. Assist the Contractor and City in monitoring the progress of the work and evaluating proposed changes to the contract, and
- d. Assist the City in administering the contract time requirements.

3. ACTIVITIES:

Each activity on the Project Schedule shall include:

- a. An activity number utilizing an alphanumeric designation system that is agreeable to the City;
- b. Concise description of the work represented by the activity; and
- c. Activity durations in whole work days with a maximum of twenty (20) work days. Durations greater than twenty (20) work days may be used for non-construction activities (mobilization, submittal preparation, curing, etc.), and other activities mutually agreeable between the City and Contractor.

The Contractor shall provide to the City a legend for all abbreviations. The activities shall be coded so that organized plots of the

Project Schedule may be produced. Typical activity coding includes traffic control phase, location and work type. Show an estimated production rate per working day for each work activity. Activity durations shall be based on production rates shown.

4. WORK DURATION AND RESOURCES:

The schedule layout shall be grouped by Project and then by Work Breakdown Structure (WBS) for organizational purposes. The original and remaining duration shall be displayed. The grouping band will, by default, report work days planned. One additional level of effort activity shall be added to the schedule as a "time calculator" with a seven-day calendar without holidays. The calculation of their days will show up in the duration columns in Primavera.

If specified by general note, the Contractor shall plan and incorporate major resources into the Project Schedule. Major resources are defined as crews and equipment that constrain the Contractor from pursuing available work. The resources shall accurately represent the Contractor's planned equipment and manpower to achieve the productivity rates specified above.

Work shall be scheduled based upon the Contractor's standard work week utilizing the appropriate calendar assignments in Primavera software. If the Contractor's initial baseline plan is to perform the Work on a six or seven-day work week, then the appropriate calendar in Primavera must be used and the Engineer must be notified in writing through the Submittal process. This does not affect the total calendar days allotted by the contract.

Assign working calendars for the days you plan to work. Designate all City holidays (12) as non-working days (holidays). For dates beyond the current calendar year assume that

the City holidays are the same as the current calendar year.

Seasonal weather conditions shall be considered and included in the Project Schedule for all work influenced by temperature and/or precipitation. Seasonal weather conditions shall be determined by an assessment of average historical climatic conditions. Average historical weather data is available through the National Oceanic and Atmospheric Administration (NOAA). These effects will be simulated through the use of work calendars for each major work type (i.e., earthwork, concrete paving, structures, asphalt, drainage, etc.). Project and work calendars should be updated each month to show days actually able to work on the various work activities.

Total float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, for each and every activity in the schedule. Float time in the Project Schedule is a shared commodity between the City and the Contractor.

Only City responsible delays in activities that affect milestone dates or the contract completion date, as determined by CPM analysis, will be considered for a time extension.

5. OTHER REQUIREMENTS:

Code and organize all work by Work Breakdown Structure (WBS). An example WBS will be provided by the City.

Percent complete type shall be Duration Percent Complete.

Duration type shall be Fixed Units

Submittals shall be included in the schedule with a logical tie to what each drives.

Proposed Change Orders shall be added the schedule identifying it as a Proposed Change Order. This task must be linked to the schedule with logical ties and approved by the City. Upon approval of Change Order, task will be renamed identifying work performed and Change Order number and resources will be added to the task.

Constraints are limited to project start, project finish, material delivery, and use on Submittals. If a schedule requires additional constraints, then an explanation shall accompany the schedule Submittal.

The schedule shall include activity milestones for material delivery.

Default progress is disallowed.

If work is performed out of sequence, then an explanation must be included in the project narrative.

JOINT REVIEW, REVISION AND ACCEPTANCE

Within twenty (20) calendar days of receipt of the Contractor's proposed Project Schedule, the City shall evaluate the schedule for compliance with this specification, and notify the Contractor of its findings. If the City requests a revision or justification, the Contractor shall provide a satisfactory revision or adequate justification to the satisfaction of the City within seven (7) calendar days. If the Contractor submits a Project Schedule for acceptance, which is based on a sequence of work not shown in the plans, then the Contractor shall notify the City in writing, separate from the schedule submittal.

The City's review and acceptance of the Contractor's Project Schedule is for conformance to the requirements of the

contract documents only. Review and acceptance by the City of the Contractor's Project Schedule does not relieve the Contractor of any of its responsibility for the Project Schedule or of the Contractor's ability to meet interim milestone dates (if specified) and the contract completion date, nor does such review and acceptance expressly or by implication warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the Contractor's Project Schedule. In the event the Contractor fails to define any element of work, activity or logic and the City review does not detect this omission or error, such omission or error, when discovered by the Contractor or City shall be corrected by the Contractor at the next monthly schedule update and shall not affect the project completion date.

Acceptance by the City of a Baseline or project update schedule that exceeds contractual time does not alleviate the Contractor from meeting the contractual completion date.

Payment may be delayed until acceptable baseline or updated schedule is received and accepted by the City.

UPDATES

The Project Schedule shall be updated on a monthly basis. The Project Schedule update shall be submitted one week prior to the pay application submittal. The Contractor shall meet with the City each month at a scheduled update meeting to review actual progress made through the Data Date of the schedule update as determined by the Project Manager. The review of progress will include dates activities actually started and/or completed, the percentage of work completed, the remaining duration of each activity started and/or completed, and the amount of work to complete with an analysis of the relationship

between the remaining duration of the activity and the quantity of material to install over that given period of time with a citation of past productivity. The monthly schedule update shall include a progress narrative explaining progress, identifying progress made out of sequence, defining the Critical Path, identification of any potential delays, etc. The Project Schedule Narrative template will be required for the narrative.

The project schedule update layout shall be grouped by Project, then WBS. The layout shall include the following columns:

- a. Activity ID
- b. Activity Description
- c. Original Durations
- d. Remaining Durations
- e. Start and Finish Dates
- f. Baseline Start and Finish Dates
- g. Total Float
- h. Performance Percent Complete
- i. Display logic and target bars in the Gantt bar chart view

PROJECT SCHEDULE REVISIONS

If the Contractor desires to make major changes in the Project Schedule, the Contractor shall notify the City in writing and submit the proposed schedule revision. The written notification shall include the reason for the proposed revision, what the revision is comprised of, and how the revision was incorporated into the schedule. Major changes are hereby defined as those that may affect compliance with the contract requirements or those that change the critical path. All other changes may be accomplished through the monthly updating process without written notification.

TIME IMPACT ANALYSIS

The Contractor shall notify the City when an impact may justify an extension of contract time or adjustment of milestone dates. This notice shall be made in writing as soon as

possible, but no later than the end of the next estimate period after the commencement of an impact or the notice for a change is given to the Contractor. Not providing notice to the City within twenty (20) calendar days after receipt will indicate the Contractor's approval of the time charges as shown on that time statement. Future consideration of that statement will not be permitted and the Contractor forfeits his right to subsequently request a time extension or time suspension unless the circumstances are such that the Contractor could not reasonably have knowledge of the impact by the end of the next estimate period.

When changes are initiated or impacts are experienced, the Contractor shall submit to the City a written time impact analysis describing the influence of each change or impact. A "time impact analysis" is an evaluation of the effects of changes in the construction sequence, contract, plans, or site conditions on the Contractor's plan for constructing the project, as represented by the schedule. The purpose of the time impact analysis is to determine if the overall project has been delayed, and if necessary, to provide the Contractor and the City a basis for making adjustments to the contract.

A time impact analysis shall consist of one or all of the steps listed below:

1. Establish the status of the project before the impact using the most recent project schedule update prior to the impact occurrence.
2. Predict the effect of the impact on the most recent project schedule update prior to the impact occurrence. This requires estimating the duration of the impact and inserting the impact into the schedule update. Any other changes made to the schedule including modifications to the

calendars or constraints shall be noted.

3. Track the effects of the impact on the schedule during its occurrence. Note any changes in sequencing, and mitigation efforts.
4. Compare the status of the work prior to the impact (Step 1) to the prediction of the effect of the impact (Step 2), and to the status of the work during and after the effects of the impact are over (Step 3). Note that if an impact causes a lack of access to a portion of the project, the effects of the impact may extend to include a reasonable period for remobilization.

The time impact analysis shall be electronically submitted to the City. If the Project Schedule is revised after the submittal of a time impact analysis but prior to its approval, the Contractor shall promptly indicate in writing to the City the need for any modification to its time impact analysis. One (1) copy of each time impact analysis shall be submitted within fourteen (14) calendar days after the completion of an impact. The City may require Step 1 and Step 2 of the time impact analysis be submitted at the commencement of the impact, if needed to make a decision regarding the suspension of contract time. Approval or rejection of each time impact analysis by the City shall be made within fourteen (14) calendar days after receipt unless subsequent meetings and negotiations are necessary.

MEASUREMENT and PAYMENT

Project Schedule will not be measured or paid for directly, but shall be included in the unit price bid for the items of construction in which the operations occur.

PROJECT SCHEDULE NARRATIVE

| | |
|------------------|--|
| PROJECT NAME: | |
| CONTRACTOR NAME: | |
| PERIOD ENDING: | |
| SUBMITTAL DATE: | |
| PREPARED BY: | |

| Evaluation Summary | |
|--|--|
| NTP: | |
| Data Date: | |
| Contractual Completion Date: | |
| Current Scheduled Completion Date: | |
| Previous Period Scheduled Completion Date: | |
| Contract Calendar Days: | |

Yes No

| Yes | No | |
|-----|----|---|
| | | Contractor has included both a hard copy (pdf) and the native Primavera file format? |
| | | Project calendars have been updated to reflect actual charged working days for the progress period, according to the contract time statement? |
| | | Schedule update reflects approved change orders for the progress period? |
| | | Have any major changes been made to the schedule? <i>(A major change is defined as those that may affect compliance with the contract requirements or those that change the critical path. If yes, written notification is required to include the reason for the proposed revision, what the revision is comprised of, and how the revision was incorporated into the schedule.)</i> If yes, provide details in Section 3 & 5 below. |
| | | Are any delays included in this schedule submittal for which the Contractor intends to submit a Time Impact Analysis (TIA) for a claim delay? If yes, provide details in Section 6 below. |

| |
|---|
| <p>1. Identify general progress for the update period.</p> |
| <p>2. Identify work performed out of sequence and provide an explanation for the reason.</p> |

| |
|---|
| 3. Describe any changes made to the project's logic and the reason for the change(s). |
| |
| 4. Identify any new constraints used and provide an explanation for their use. |
| |
| 5. Define the critical path of the project, including any changes from the previous update. |
| |
| 6. Identify any delays that have occurred for the progress period, the reason for the delay, and current status. |
| |
| 7. Identify any potential delays and possible mitigation efforts. |
| |
| 8. Other comments. |
| |



CITY OF SAN ANTONIO
**CAPITAL IMPROVEMENTS
MANAGEMENT SERVICES**

P.O. Box 839966 • San Antonio, Texas 78283-3966

June 26, 2013

Dear Contractor;

For all current and future projects awarded by the City of San Antonio, kindly be aware that you are required to adhere to the terms and conditions of the General Conditions for City of San Antonio Construction Contracts (hereafter referred to as the "General Conditions"). It is through those General Conditions that the City is able to ensure projects are built correctly and the project proceeds as required by the City.

Schedule Requirement

One of the key provisions of those General Conditions is **Section 3.10**, titled Contractor's Project Schedules. Under the City's General Conditions, among other obligations, a Contractor is obligated to create and maintain a Critical Path Method (hereafter referred to as "CPM") Project Schedule, showing the manner of execution of Work by which the Contractor intends to follow, in order to complete the Project within the allotted time. This CMP Schedule is required to be in Primavera 5.0 or Contractor 4.1 or greater submitted electronically to the CIMS Schedule and Project Manager.

Schedule Updates

After acceptance of the Contractor's CPM Project Schedule the City, pursuant to **Section 3.10.9** of the General Conditions, Contractor is required to submit a thorough schedule update, to reflect progress to date on the Project and to reflect the current plans of Contractor to complete the Project on a monthly basis.

If Contractor has failed to submit an updated Project schedule, the City reserves the right to withhold payment until the Contractor complies with the schedule update requirement.

Time Impact Analysis

Under **Section 3.10 et al.** of the General Conditions, if a Contractor knows of an event that has occurred or will occur that will impact Contractor's submitted and approved schedule, the



CITY OF SAN ANTONIO
**CAPITAL IMPROVEMENTS
MANAGEMENT SERVICES**

P.O. Box 839966 • San Antonio, Texas 78283-3966

Contractor is required to notify the City of the occurrence of the event causing the impact to the schedule within twenty (20) calendar days of the event. Failure to file such notification of an impact to the schedule with the City, results in the forfeiture of the Contractor's right to request a time extension or time suspension, based on the occurrence of that event.

Additionally, when changes are initiated or impacts are experienced, the Contractor electronically shall submit to the City a written Time Impact Analysis describing the influence of each change or impact. A Time Impact Analysis will be required as justification for making time adjustments to the Contract's completion date.

Recovery / Acceleration Schedule

Finally, under **Section 3.10.2** of the General Conditions, upon submission of the schedule update by the Contractor and review by the City, if the City concludes that the Contractor rate of Work is inadequate such that the Contractor will be unable to meet the contract Milestones or the contract's Substantial Completion date, the City then "may give written notice to the Contractor and direct the Contractor, at Contractor's sole expense, to propose and adopt a plan to accelerate the Work so that the Work conforms to the Project Schedule and Project Milestones previously agreed upon" by the City and the Contractor.

If you have any questions about any of the information contained in this letter, or if you wish to discuss any of the items addressed herein, do not hesitate to contact Thomas Gonzalez at (210) 207-1328 or CIMS.Schedules@sanantonio.gov.

Sincerely,

Lisa Torres
CIMS Scheduler

CC: Razi Hosseini, P.E.
Ruben Guerrero, P.E.

ITEM 800

PROJECT SIGNS

800.1 DESCRIPTION: This item shall consist of providing, installing, maintaining and (at the completion of the project) removing two (2) 4' X 8' project signs. The signs shall conform to the configuration and details indicated in a special sheet in the project specifications titled PROJECT SIGN DETAILS. These signs shall be installed at locations to be determined by the inspector.

800.2 MATERIAL: The signs shall be made of 3/4" plywood, grade A-C or better and each shall be mounted on two (2) 4" X 4" X 12' - 0" posts.

800.3 INSTALLATION: The installation will require embedding all posts a minimum of 3' - 0" below the ground.

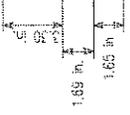
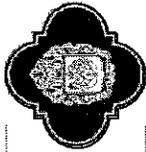
800.4 PAYMENT: No direct payment will be made to the contractor for the work and materials required in providing, installing, maintaining and removing the signs. Such work and materials shall be considered subsidiary to the several items of work for which unit prices are provided in the proposal.

56. ft.

CITY OF SAN ANTONIO

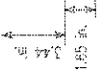
AVIATION DEPARTMENT
PROJECT NAME

\$ AMOUNT CAPITAL IMPROVEMENTS PROJECT
FUNDING SOURCE
DESIGN ENGINEER/ARCHITECT
CONTRACTOR

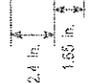


6.90 ft.
7.75 ft.

CITY MANAGER
Sheryl Sculley



AVIATION DEPARTMENT
DIRECTOR
Frank R. Miller



MAYOR
Julían Castro



CITY COUNCIL
Diego M. Bernal
Ivy R. Taylor
Rebecca Viagran
Rey Saldaña
Shirley Gonzales



Ray Lopez
Cris Medina
Ron Nirenberg
Elisa Chan
Carlton Soules



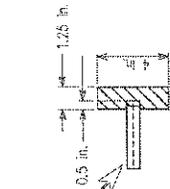
21.75 ft.

WHITE
BACK -
GROUND

FOR MORE INFORMATION CALL 207-8140
AFTER HOURS EMERGENCIES CALL 311 AND REFER TO PROJECT: _____ PROJECT NAME

PROVIDE ADEQUATE SUPPORTS FOR SIGN AS
SITE CONDITIONS MAY REQUIRE AND KEEP SIGN
PROPER DISTANCE ABOVE PREVAILING GRADE TO
PERMIT PUBLIC VIEWING

GRADE



EXTERIOR TYPE HIGH DENSITY
OVERLAIN PLYWOOD OR OTHER
APPROVED MATERIAL SUITABLE
FOR SIGNS.

LEFT BORDER SHALL BE
DETERMINED USING THE
LONGEST LINE CENTERED
ON THE SIGN PROVIDING
EQUAL BORDERS

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

0123456789!\$%&-0 < > : ; , / ?

APPENDICES

SAAS Safety Plan

Painting, Marking and Lighting of Vehicles used on an Airport

Operational Safety on Airports during Construction

**Construction Safety and Phasing Report
(Bound Separately)**

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SAAS Minimum Requirements for Contractor who elect to use SAAS Safety Plan

Minimum requirements for Contracts that deal with Construction Projects at SAAS should state:

"As a minimum the Safety Plan/Program must be in compliance with OSHA 29CFR 1910.132 – General Requirement, 1910.135 – Head Protection, 1910-133 – Eye and Face Protection, 1926-52(b) – Hearing Protection, 1926.103 – Respiratory Protection, 1910.95 – Personal Protective Equipment (PPE) and Life Saving Equipment and 1910.245 – Safety Signs. The Contractor must state which program he will follow during the construction period."

NOTE: Using the SAAS Minimum Requirements does not relieve the Contractor of its responsibility to meet the OSHA requirements.

Prior to Contract Award

1. If Prime Contractor has a Safety Plan/Program it must be review and approved by SAAS Safety Division, once construction starts San Antonio Safety Division will drop in unannounced periodically at the construction site to ensure compliance with the Company Safety Program. All subcontractors must comply with Prime Contractor Safety Plan/Program. At anytime it is noted that a worker/contractor is not in compliance it could be cause for Aviation Safety to curtail construction until everyone is in compliance.
2. If the Contractor elects to use San Antonio Aviation System (SAAS) Safety Plan/Program requirements, are as follows:
 - a. All PPE will meet American National Standards Institute.
 - i. Hard Hats will meet ANSI Standard Z89.1-2003,
 - ii. Reflective Safety Vest will be ANSI 2, Class 2 or greater and will be worn correctly in accordance with the Airport Rules and Regulations, i.e. fasten in the front.
 - iii. Safety Glasses or Goggles will meet ANSI Standard Z87.1-2003,
 - iv. Ear Protection must be in the form of Ear Muffs or ear plugs with a NRR rating of 30 or greater.
 - v. Eye Protection will meet ANSI Standard Z87.1-2003
 - vi. Respirators as required for specific job function.
 - b. Minimum PPE required on the job site is listed below. The PPE must be worn at all time while inside/on the job site.
 - i. Hard Hats,
 - ii. Reflective Safety Vest
 - iii. Eye Protection
 - c. The job site will have the following signage post at the entrance of the job site, as a minimum, as indicated below. The sign material and colors are set forth in American National Standards and are linked on OSHA's website.
 - i. Danger Signs – OSHA requires danger signs will be red for the upper panel with a black outline on the borders and a white lower panel for additional wording. No variations are permitted. OSHA requires employers to educate employees that danger signs mean "immediate danger" and that precautions are necessary. Images of acceptable danger signs are contained in OSHA's regulations

1. "DANGER" – Additional Wording "Construction Area"



- ii. Caution Signs – The purpose of caution signs is to warn of potential hazards or to caution against unsafe practices. According to OSHA regulations, caution signs have a yellow background. Black is required for the upper panel with yellow lettering, reading "CAUTION." The lower yellow panel is for additional wording that must be black.
 1. "CAUTION" – Additional Wording "PPE Required – Hard Hats, Safety Glasses , Safety Vest as a minimum"



- d. RESPONSIBILITIES
 - i. Prime Contractor will appoint a Safety Representative for the job site and furnish name and contact information to SAAS Planning and Development Division and Safety Division.
 - ii. Prime Contractor will ensure that all employees are properly trained in all aspects of OSHA required training. Must be able to show that all employees are trained if asked.
 - iii. Superintendent/Supervisor shall
 1. Ensure that PPE is available for all employees under their control
 2. Ensure employees are trained on the proper use, care, and cleansing of PPE
 3. Maintain records on PPE assignments and training

4. Ensure that anyone (workers, engineers, inspectors and visitors) who enters job site has as minimum PPE on prior to entering the job sight and during the duration of time while on the job site.
 - a. Hard Hats
 - b. Reflective Safety Vest
 - c. Safety Glasses
5. Post all the appropriate signage on the wall in the vicinity of the job site entrance, as a stated in paragraph 2C
- iv. Employee shall
 1. Wear the required PPE
 2. Notify the supervisor of the need to repair or replace PPE
- v. Aviation Department Safety Division/Planning and Development Division will visit the job site periodically to ensure that the Prime and subcontractors or incompliance with either the Prime Contractor Safety Plan/Program or SAAS Safety Plan/Program for Construction site per the awarded contract.

// S I G N E D //
JOHN C CHASE,
Safety Management System
Manager

15 Jul 2012

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U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: Painting, Marking, and Lighting of
Vehicles Used on an Airport

Date: April 1, 2010

AC No: AC 150/5210-5D

Initiated by: AAS-100

Change:

1. PURPOSE. This advisory circular (AC) provides guidance, specifications, and standards for painting, marking, and lighting of vehicles operating in the airport air operations area (AOA). The approved lights, colors, and markings herein assure the conspicuity of vehicles operating in the AOA from both the ground and the air.

2. CANCELLATION. This AC cancels AC 150/5210-5C, Painting, Marking, and Lighting of Vehicles Used on an Airport, dated August 31, 2007.

3. APPLICATION. The Federal Aviation Administration (FAA) recommends the guidelines and standards in this Advisory Circular for vehicles operating in the airport AOA. In general, use of this AC is not mandatory. *However*, use of this AC is mandatory for vehicles funded with federal grant monies through the Airport Improvement Program (AIP) and/or with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standard and Specifications."

Vehicles covered by this AC that do not meet this standard may be used until the vehicle is repainted or replaced, but no later than **December 31, 2010**.

4. PRINCIPAL CHANGES. This AC contains new specifications and recommendations for the painting, marking, and lighting of Towbarless Tow Vehicles (TLTVs).

5. METRIC UNITS. To promote an orderly transition to metric units, this AC includes both English and metric dimensions. The metric conversions may not be exact equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

6. COMMENTS OR SUGGESTIONS for improvements to this AC should be sent to:

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue, S.W.
Washington, DC 20591

Michael J. O'Donnell
Director of Airport Safety and Standards

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PAINTING, MARKING, AND LIGHTING OF VEHICLES USED ON AN AIRPORT

1. SOURCES OF APPLICABLE DOCUMENTS.

- a.** American National Standards Institute, Inc. (ANSI), 25 West 43rd St. 4th Floor, New York, NY 10036. Website: www.ansi.org
- b.** American Society for Testing & Materials (ASTM), ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. Website: www.astm.org
- c.** The National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, Massachusetts 02169-7471. Website: www.nfpa.org
- d.** The U. S. General Services Administration (GSA), Centralized Mailing List Services, 501 West Felix Street, Whse 9, South End P.O. Box 6477, Fort Worth, Texas 76115-6477. Website: www.gsa.gov
- e.** The Superintendent of Documents, U.S. Government Printing Office, 732 North Capitol St. NW, Washington, DC 20401.
- f.** Society of Automotive Engineers, Inc. (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001. Website: www.sae.org
- g.** FAA Advisory Circulars: U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Ave., Landover, MD 20785. Website: www.faa.gov
- h.** FAA Engineering Briefs: www.faa.gov/airports/engineering/engineering_briefs/

2. DEFINITIONS. The following definitions apply in this AC:

- a. Vehicle** – All conveyances, except aircraft, used on the ground to transport persons, cargo, equipment or those required to perform maintenance, construction, service, and security duties.
- b. Air Operations Area (AOA)** – The portion of airport that encompasses the landing, take off, taxiing, and parking areas for aircraft.
- c. Airport Emergency Vehicles** – Vehicles that are authorized in the AOA for emergency purposes (e.g., ambulances, aircraft rescue and fire fighting (ARFF) vehicles and emergency response vehicles) as authorized by the airport traffic control tower (ATCT) or an authorized on-site accident/incident commander.
- d. Airport Operations Vehicles** – Vehicles routinely used by airport operations personnel for airport inspection and duties associated with airfield operations (such as airfield condition reporting and Incident Command) on the AOA and Movement Area.
- e. Airport Security Vehicles** – Vehicles that are authorized in the AOA for security purposes, as needed (e.g. police cars).

- f. Airfield Service Vehicles** – Vehicles that are routinely used in the AOA for airfield service, maintenance, or construction (e.g. snow blowers, snowplows, maintenance trucks, and tractors).
- g. Aircraft Support Vehicles** – Vehicles that are routinely used in the AOA to support aircraft operations (e.g. aircraft pushback tractors, baggage/cargo tractors or trucks, air conditioning and aviation fuel trucks). These vehicles are typically owned by airlines, vendors, or contractors and are not eligible for Federal funding.
- h. Reduced Visibility** – Prevailing visibility is less than one statute mile (1609 meters) and/or the runway visual range (RVR) is less than 6,000 feet (1830 meters).
- i. Movement Area** – The runways, taxiways, and other areas of an airport/heliport that are used for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with an operating airport traffic control tower (ATCT), specific approval for entry onto the movement area must be obtained from air traffic control (ATC).
- j. Other Vehicles** – Vehicles that are not routinely authorized in the AOA (e.g. construction vehicles). These vehicles are typically owned by airlines, vendors, or contractors and are not eligible for Federal funding.
- k. Peak Intensity** – Peak intensity, for purposes of this document, means the maximum magnitude of luminescence as measured in candela.
- l. Towbarless Tow Vehicle (TLTV)** – a type of aircraft support vehicle whose main purpose is to tow aircraft in the AOA by way of nose gear capture.

3. VEHICLE PAINTING.

NOTE: *Airport vehicle paint and markings are a safety of flight requirement. The approved colors/markings herein assure conspicuity of vehicles operating in the AOA from both the ground and air.*

a. Airport Emergency Vehicles.

(1) Ambulances. Ambulance vehicles are painted per the most current version of Federal Specification KKK-A-1822, *Federal Specification for the Star-of-Life Ambulance*. Ambulances are not considered vehicles routinely operating on the AOA.

(2) Aircraft Rescue and Fire Fighting (ARFF) Vehicles. Yellowish-green is the vehicle color standard. Color specifications are per Appendix A.

NOTE: *A yellowish-green color provides optimum visibility during all light levels encountered during a 24-hour day and under variations of light that result from weather and seasonal changes.*

b. Airport Operations Vehicles. Airport operations vehicles may be painted in colors designated by the airport operator. The characteristics must be coordinated with the respective ATCT and identified in the tower letter of agreement.

c. Airport Security Vehicles. Comply with specific state or local requirements.

d. Airfield Service Vehicles. Chrome yellow is the vehicle color standard. Color specifications are per Appendix A. When vehicles are equipped with bumper bars 8 inches (200 mm) or more in depth, the bars must be painted in alternate stripes 4 inches (100 mm) in width of chrome yellow and black inclined 45° to the vertical.

e. Aircraft Support Vehicles.

(1) Any color or combination of colors other than yellowish-green or chrome yellow. The bumper bar paint scheme in paragraph 3.d (of alternating chrome yellow and black stripe) is recommended.

(2) **TLTVs.** International orange is the vehicle color standard. Retroreflective tape covering more than 25 percent of the vehicle's vertical surfaces may be used as a temporary measure to meet this standard prior to scheduled vehicle painting.

f. Other Vehicles. Any color or combination of colors other than solid black or white.

4. VEHICLE MARKING.

a. Airport Emergency Vehicles.

(1) **Ambulances.** Ambulances are marked per the most current version of Federal Specification KKK-A-1822.

(2) **ARFF Vehicles.** Emergency rescue and fire fighting vehicles are marked with the letters "ARFF," "Fire," or "Rescue" and in accordance with 4.c.(1)-(5) of this AC.

b. Airport Operations Vehicles. Airport operations vehicles may be marked as designated by the airport operator. Marking must be coordinated with the respective ATCT and identified in the tower letter of agreement.

c. Airfield Service Vehicles and Aircraft Support Vehicles.

(1) Airport operator owned vehicles must display an identification number on each side and on the roof (the hood should be used if the vehicle has no roof).

(2) Side numbers will be a minimum of 16 inches (410 mm) in height and conspicuously located.

(3) Roof numbers will be a minimum of 24 inches (610 mm) in height and affixed with their bases toward the front of the vehicle. The identification numbers should provide sharp color contrast to the vehicle color.

(4) In addition to the identification numbers, airport operator-owned vehicles must display either the name of the airport and/or the airport insignia.

(5) To further improve night-time recognition of vehicles, a minimum 8 inch (200 mm) wide horizontal band of high gloss white paint or white reflective tape (Retroreflective, ASTM-D 4956-09, *Standard Specification for Retroreflective Sheeting for Traffic Control*, Type III & above) must be used around the vehicle's surface. Figures 1, 2, and 3 show suggested locations for the horizontal reflective band.

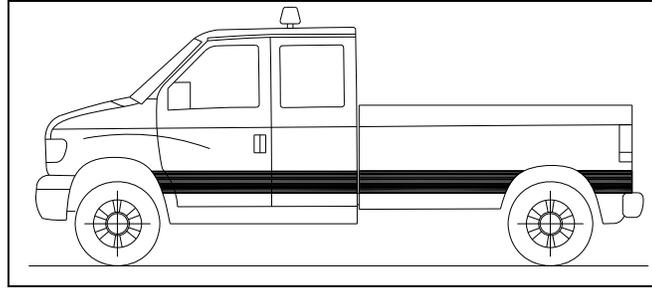


Figure 1: Suggested location for the horizontal reflective band, Option 1

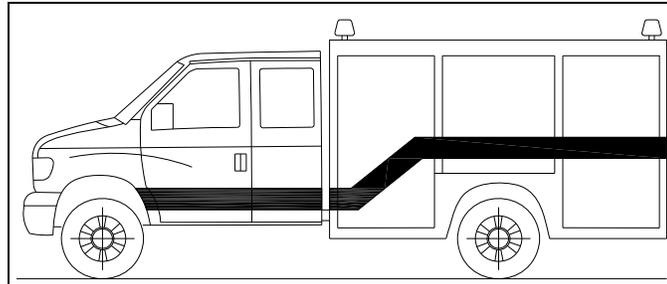


Figure 2: Suggested location for the horizontal reflective band, Option 2

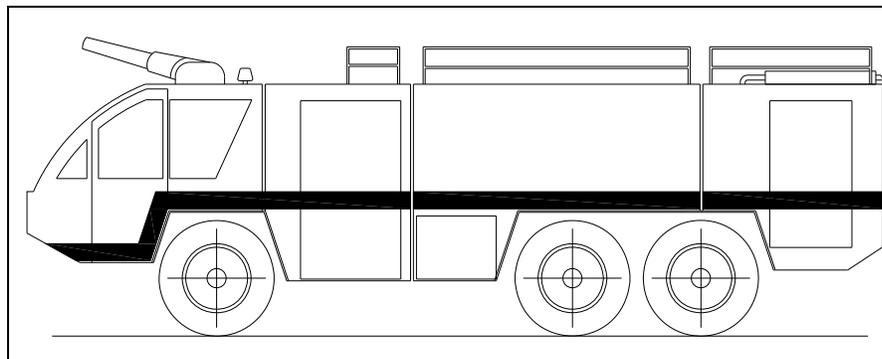


Figure 3: Suggested location for the horizontal reflective band, Option 3

(6) **TLTVs.** Retroreflective tape is used to outline the shape of a TLTV. If the vertical edge of the vehicle is rounded, the tape should be placed on the rounded portion to reflect light in both the horizontal and vertical planes. Where the placement of the tape may interfere with, or may be worn down by, maintenance or operational activities, tape is not required. Suggested locations for the retroreflective bands are shown in Figure 4.

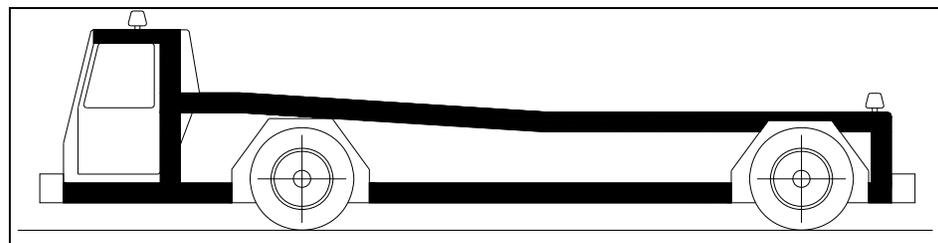


Figure 4: Suggested placement of retroreflective tape on a TLTV

d. Airport Security and Other Vehicles.

- (1) Vehicles other than those that routinely traverse any portion of the AOA under the control of ATC, which are not escorted by a vehicle in constant two-way radio communication with ATC and properly equipped and authorized to operate in the AOA, must be provided with a flag on a staff attached to the vehicle so that the flag will be readily visible.
- (2) At airports without air traffic control facilities, flags must be provided on all vehicles.
- (3) The flag must be at least a 3-foot by 3-foot (0.9 meter by 0.9 meter) square having a checkered pattern of international orange and white squares at least 1 foot (300 mm) on each side (see Appendix A for the fabric color specification).

5. VEHICLE LIGHTING.

a. Airfield Service, Aircraft Support, and Airport Operations Vehicles.

- (1) The standard for identification lighting is a yellow flashing light that is mounted on the uppermost part of the vehicle structure. A steady yellow light designates vehicles limited to non-movement areas.
- (2) The light must be visible from any direction, day and night, including from the air.
- (3) Color specifications for vehicle identification lights are per Appendix B.
- (4) **TLTVs.** An LED light bar placed above the operator's cab may be used in place of the rotating yellow flashing light. In addition, a yellow flashing light (of any type) must be installed on the upper left-rear and right-rear corners of the TLTV, and must be activated when an aircraft is in tow. The size of the rear flashing lights must be large enough to meet the requirements of Section 5.c, but not so large as to interfere with the normal or towing operations of the TLTV.

b. Airport Emergency, Security, and Other Vehicles, which are not escorted by a properly lighted vehicle, must be identified during periods of low visibility by a light.

c. Characteristics of Flashing Lights:

- (1) Ambulance lights must meet the specifications in the most current version of Federal Specification KKK-A-1822, and ARFF vehicles must meet NFPA, state, and local requirements.
- (2) Lights must have peak intensity within the range of 40 to 400 candelas (effective) from 0° (horizontal) up to 10° above the horizontal and for 360° horizontally. The upper limit of 400 candelas (effective) is necessary to avoid damage to night vision.
- (3) From 10° to 15° above the horizontal plane, the light output must be 1/10th of peak intensity or between 4 and 40 candelas (effective).

- (4) Lights must flash at 75 ± 15 flashes per minute.

NOTES:

1. *The effective intensity of a flashing light is equal to the intensity of a steady-burning (fixed) light of the same color that produces the same visual range under identical conditions of observation.*

2. *If xenon flashtubes are used, refer to AC 150/5345-43, Specification for Obstruction Lighting Equipment, for guidance concerning methods of calculating effective intensity.*

d. Light Colors.

(1) Airport Emergency Vehicles.

(a) **Ambulances.** Per the most current version of Federal Specification KKK-A-1822.

(b) **ARFF Vehicles.** Red or a combination of red-and-white flashing lights per the chromaticity requirements in Appendix B.

(2) Airport Security Vehicles. Signal blue or a combination of red and signal blue flashing light per the chromaticity requirements in Appendix B.

(3) Airfield Service, Aircraft Support, Airport Operations, and Other Vehicles. Yellow flashing light per the chromaticity requirements in Appendix B.

APPENDIX A. COLOR SPECIFICATIONS

A-1. SPECIFICATIONS. Colors specified in Table A-1 are per the Commission Internationale de l'Eclairage (CIE) L*a*b* system of color specification. For a description of this system, refer to American Society for Testing & Materials (ASTM) D 2244, *Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates*.

Table A-1. Specification for vehicle and flag colors

| Standard Illuminant D65 Usage | Chrome Yellow | | | Yellowish-Green | | | International Orange | | |
|-------------------------------|---------------|------|------|-----------------|-------|------|-----------------------------|------|------|
| | Vehicle Paint | | | Vehicle Paint | | | Vehicle Paint / Flag Fabric | | |
| CIELAB DATA | L* | a* | b* | L* | a* | b* | L* | a* | b* |
| Centroid Color | 72.8 | 24.4 | 77.6 | 78.3 | -10.2 | 80.4 | 45.0 | 53.5 | 52.0 |
| Point 1 | 72.8 | 31.8 | 82.9 | 78.3 | -9.0 | 92.0 | 45.0 | 61.4 | 47.8 |
| Point 2 | 72.8 | 25.5 | 66.7 | 78.3 | -7.6 | 73.2 | 45.0 | 53.9 | 41.4 |
| Point 3 | 72.8 | 18.0 | 69.3 | 78.3 | -11.0 | 69.3 | 45.0 | 53.5 | 53.4 |
| Point 4 | 72.8 | 22.4 | 86.0 | 78.3 | -13.4 | 86.2 | 45.0 | 49.7 | 60.4 |
| Light Limit | 77.8 | | | 83.3 | | | 49.9 | | |
| Dark Limit | 67.8 | | | 73.3 | | | 41.6 | | |
| Max ΔE | 11.1 | | | 11.7 | | | 10.7 | | |

A-2. COLOR TESTS. Acceptable colors are those that meet the gloss rating test and either a visual or an instrumental color test as follows:

NOTE: *Flag fabric colors must meet either the instrumental tests in Table A-1 or the visual method described in paragraph A-2b(1).*

a. Gloss Rating Test. This test is performed per ASTM D 523, *Standard Test Method for Specular Gloss*, on a paint sample of the color to be applied on the vehicle. An acceptable color sample is high gloss with a minimum gloss rating of 70 units, for 60° geometry.

b. Color Test Methods:

(1) Visual. Prepare a master specimen of the color (per Table A-1) and gloss (per paragraph A-2a). This specimen will be the master color and be used as the basis of comparison per ASTM D 5531-05, *Standard Guide for the Preparation, Maintenance, and Distribution of Physical Product Standards for Color and Geometric Appearance of Coatings*. To verify the paint color of a vehicle visually, vehicle paint samples must be

prepared and viewed per ASTM D 1729-96 (Reapproved 2009), *Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials*.

(2) Instrumental. This test requires a test specimen sample and reference to Table A-1. All test specimen measurements should be conducted per ASTM E 1164-09a *Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation*. Test specimen tolerances must be per Table A-1 per the following:

(a) Plot the centroid color using the a* and b* CIELAB coordinate data from Table A-1 on graph paper or by entry of the coordinate data into a computer program. Plot and connect points 1 through 4 from the same table to form a quadrilateral; noting that the centroid color is within this figure. See Figure A-1 for plots of all three color specifications in Table A-1.

(b) Perform color sample measurements per ASTM E 1164-09a. If necessary, convert measurements to CIELAB L*, a*, and b* color space. See ASTM E 308-08, *Standard Practice for Computing the Colors of Objects by Using the CIE System*, for color space conversion formulae.

(c) An acceptable color is one that meets:

(i) the chromaticity requirements of the color samples a* and b* CIELAB coordinate data by falling within the quadrilateral;

(ii) the L* data lightness requirement by falling within the range defined by the light and dark data of Table A-1;

(iii) the total color difference (ΔE) by not exceeding the limits in Table A-1 when the CIELAB data are computed in the following formula:

$$\Delta E = (\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2})^{\frac{1}{2}}$$

where ΔL^* , Δa^* , and Δb^* values are the differences between those values for the centroid color in Table A-1 and those of the color sample measurements.

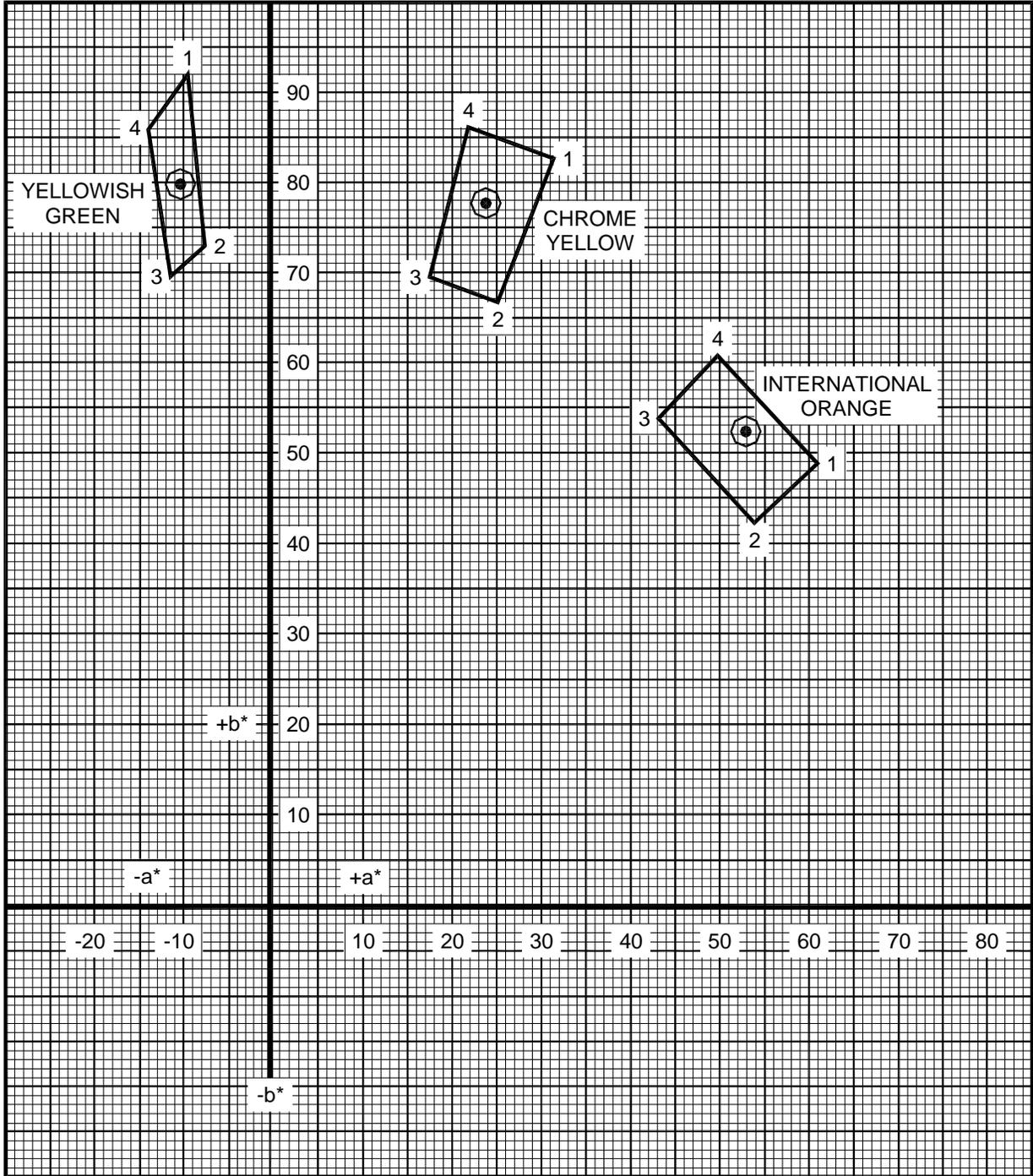


Figure A-1. Plot of selected color paint specifications

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APPENDIX B. COLOR SPECIFICATIONS FOR VEHICLE IDENTIFICATION LIGHTS

B-1. SPECIFICATIONS. The Society of Automotive Engineers (SAE) Standard J578 Revised December 2006, *Color Specification*, defines the acceptable color boundary limits and measurement of emitted red, white, signal blue, and yellow light for vehicle lights. This standard applies to the overall emitted color of light from the device in lieu of emitted light from any small area of the lens. The color of emitted light must fall within the color boundaries per SAE J578 Revised December 2006 (color boundary equations are in the standard) using color measurement methods detailed in the standard. See FAA Engineering Brief #67, *Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures*, for additional information and *Alternative Lighting Devices*.

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U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: Operational Safety on
Airports During Construction

Date: 9/29/11
Initiated by: AAS-100

AC No: 150/5370-2F

- 1. Purpose.** This AC sets forth guidelines for operational safety on airports during construction.
- 2. What this AC Cancels.** This AC cancels AC 150/5370-2E, Operational Safety on Airports During Construction, dated January 17, 2003.
- 3. Whom This AC Affects.** This AC assists airport operators in complying with Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports (Part 139). For those certificated airports, this AC provides one way, but not the only way, of meeting those requirements. The use of this AC is mandatory for those airport construction projects receiving funds under the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standard and Specifications." While we do not require non-certificated airports without grant agreements to adhere to these guidelines, we recommend that they do so to help these airports maintain operational safety during construction.
- 4. Principal Changes.**
 - a.** Construction activities are prohibited in safety areas while the associated runway or taxiway is open to aircraft.
 - b.** Guidance is provided in incorporating Safety Risk Management.
 - c.** Recommended checklists are provided for writing Construction Safety and Phasing Plans and for daily inspections.
- 5. Reading Material Related to this AC.** Numerous ACs are referenced in the text of this AC. These references do not include a revision letter, as they are to be read as referring to the latest version. Appendix 1 contains a list of reading material on airport construction, design, and potential safety hazards during construction, as well as instructions for obtaining these documents.

Michael J. O'Donnell
Director of Airport Safety and Standards

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Chapter 1. Planning an Airfield Construction Project

101. Overview. Airports are complex environments, and procedures and conditions associated with construction activities often affect aircraft operations and can jeopardize operational safety. Safety considerations are paramount and may make operational impacts unavoidable. However, 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 airport operator must understand how construction activities and aircraft operations affect one another to be able to develop an effective plan to complete the project. While the guidance in this AC is primarily used for construction operations, some of the concepts, methods and procedures described may also enhance the day-to-day airport maintenance operations, such as lighting maintenance and snow removal operations.

102. Plan for Safety. Safety, maintaining aircraft operations, and construction costs are all interrelated. Since safety must not be compromised, the airport operator must strike a balance between maintaining aircraft operations and construction costs. This balance will vary widely depending on the operational needs and resources of the airport and will require early coordination with airport users and the FAA. As the project design progresses, the necessary construction locations, activities, and associated costs will be identified. As they are identified, their impact to airport operations must be assessed. Adjustments are made to the proposed construction activities, often by phasing the project, and/or to airport operations in order to maintain operational safety. This planning effort will ultimately result in a project Construction Safety and Phasing Plan (CSPP). The development of the CSPP takes place through the following five steps:

a. Identify Affected Areas. The airport operator must determine the geographic areas on the airport affected by the construction project. Some, such as a runway extension, will be defined by the project. Others may be variable, such as the location of haul routes and material stockpiles.

b. Describe Current Operations. Identify the normal airport operations in each affected area for each phase of the project. This becomes the baseline from which the impact on operations by construction activities can be measured. This should include a narrative of the typical users and aircraft operating within the affected areas. It should also include information related to airport operations: the Aircraft Reference Code (ACRC) for each runway; Airplane Design Group (ADG) and Taxiway Design Group (TDG)¹ for each affected taxiway; designated approach visibility minimums; available approach and departure procedures; most demanding aircraft; declared distances; available air traffic control services; airport Surface Movement Guidance and Control System plan; and others. The applicable seasons, days and times for certain operations should also be identified as applicable.

c. Allow for Temporary Changes to Operations. To the extent practical, current airport operations should be maintained during the construction. In consultation with airport users, Aircraft Rescue and Fire Fighting (ARFF) personnel, and FAA Air Traffic Organization (ATO) personnel, the airport operator should identify and prioritize the airport's most important operations. The construction activities should be planned, through project phasing if necessary, to safely accommodate these operations. When the construction activities cannot be adjusted to safely maintain current operations, regardless of their importance, then the operations must be revised accordingly. Allowable changes include temporary revisions to approach procedures, restricting certain aircraft to specific runways and taxiways, suspension of certain operations, decreased weights for some aircraft due to shortened runways,

¹ Taxiway Design Group will be introduced in AC 150/5300-13A.

and other changes. An example of a table showing temporary operations versus current operations is shown in Table 3-1 Sample Operations Effects.

d. Take Required Measures to Revised Operations. Once the level and type of aircraft operations to be maintained are identified, the airport operator must determine the measures required to safely conduct the planned operations during the construction. These measures will result in associated costs, which can be broadly interpreted to include not only direct construction costs, but also loss of revenue from impacted operations. Analysis of costs may indicate a need to reevaluate allowable changes to operations. As aircraft operations and allowable changes will vary so widely among airports, this AC presents general guidance on those subjects.

e. Manage Safety Risk. Certain airport projects may require the airport operator to provide a Project Proposal Summary to help the FAA to determine the appropriate level of Safety Risk Management (SRM) documentation. The airport operator must coordinate with the appropriate FAA Airports Regional or District Office early in the development of the CSPP to determine the need for SRM documentation. See FAA Order 5200.11, FAA Airports (ARP) Safety Management System (SMS), for more information. If the FAA requires SRM documentation, the airport operator must at a minimum:

- (1) **Notify the appropriate FAA Airports Regional or District Office** during the project “scope development” phase of any project requiring a CSPP.
- (2) **Provide documents** identified by the FAA as necessary to conduct SRM.
- (3) **Participate in the SRM process** for airport projects.
- (4) **Provide a representative** to participate on the SRM panel.
- (5) **Ensure that all applicable SRM identified risks elements are recorded** and mitigated within the CSPP.

103. Develop a Construction Safety and Phasing Plan (CSPP). Development of an effective CSPP will require familiarity with many other documents referenced throughout this AC. See Appendix 1, Related Reading Material for a list of related reading material.

a. List Requirements. A CSPP must be developed for each on-airfield construction project funded by the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) program or located on an airport certificated under Part 139. As per Order 5200.11, such projects do not include construction, rehabilitation, or change of any facility that is entirely outside the air operations area, does not involve any expansion of the facility envelope and does not involve construction equipment, haul routes or placement of material in locations that require access to the air operations area, increase the facility envelope, or impact line-of-sight. Such facilities may include passenger terminals and parking or other structures. However, extraordinary circumstances may trigger the need for a Safety Assessment and a CSPP. The CSPP is subject to subsequent review and approval under the FAA’s Safety Risk Management procedures (see paragraph 102.e above). Additional information may be found in Order 5200.11.

b. Prepare a Safety Plan Compliance Document. The Safety Plan Compliance Document (SPCD) details how the contractor will comply with the CSPP. Also, it will not be possible to determine all safety plan details (for example specific hazard equipment and lighting, contractor’s points of contact, construction equipment heights) during the development of the CSPP. The successful contractor must define such details by preparing an SPCD that the airport operator reviews for approval prior to issuance of a notice-to-proceed. The SPCD is a subset of the CSPP, similar to how a shop drawing review is a subset to the technical specifications.

c. Assume Responsibility for the CSPP. The airport operator is responsible for establishing and enforcing the CSPP. The airport operator may use the services of an engineering consultant to help develop the CSPP. However, writing the CSPP cannot be delegated to the construction contractor. Only those details the airport operator determines cannot be addressed before contract award are developed by the contractor and submitted for approval as the SPCD. The SPCD does not restate nor propose differences to provisions already addressed in the CSPP.

104. Who Is Responsible for Safety During Construction?

a. Establish a Safety Culture. Everyone has a role in operational safety on airports during construction: the airport operator, the airport's consultants, the construction contractor and subcontractors, airport users, airport tenants, ARFF personnel, Air Traffic personnel, including Technical Operations personnel, FAA Airports Division personnel, and others. Close communication and coordination between all affected parties is the key to maintaining safe operations. Such communication and coordination should start at the project scoping meeting and continue through the completion of the project. The airport operator and contractor should conduct onsite safety inspections throughout the project and immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

b. Assess Airport Operator's Responsibilities. An airport operator has overall responsibility for all activities on an airport, including construction. This includes the predesign, design, preconstruction, construction, and inspection phases. Additional information on the responsibilities listed below can be found throughout this AC. The airport operator must:

(1) Develop a CSPP that complies with the safety guidelines of Chapter 2, Construction Safety and Phasing Plans, and Chapter 3, Guidelines for Writing a CSPP. The airport operator may develop the CSPP internally or have a consultant develop the CSPP for approval by the airport operator. For tenant sponsored projects, approve a CSPP developed by the tenant or its consultant.

(2) Require, review and approve the SPCD by the contractor that indicates how it will comply with the CSPP and provides details that cannot be determined before contract award.

(3) Convene a preconstruction meeting with the construction contractor, consultant, airport employees and, if appropriate, tenant sponsor and other tenants to review and discuss project safety before beginning construction activity. The appropriate FAA representatives should be invited to attend the meeting. See AC 150/5300-9, *Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects*. (Note "FAA" refers to the Airports Regional or District Office, the Air Traffic Organization, Flight Standards Service, and other offices that support airport operations, flight regulations, and construction/environmental policies.)

(4) Ensure contact information is accurate for each representative/point of contact identified in the CSPP and SPCD.

(5) Hold weekly or, if necessary, daily safety meetings with all affected parties to coordinate activities.

(6) Notify users, ARFF personnel, and FAA ATO personnel of construction and conditions that may adversely affect the operational safety of the airport via Notices to Airmen (NOTAM) and other methods, as appropriate. Convene a meeting for review and discussion if necessary.

(7) Ensure construction personnel know of any applicable airport procedures and of changes to those procedures that may affect their work.

(8) Ensure construction contractors and subcontractors undergo training required by the CSPP and SPCD.

(9) **Ensure vehicle and pedestrian operations** addressed in the CSPP and SPCD are coordinated with airport tenants, the airport traffic control tower (ATCT), and construction contractors.

(10) **At certificated airports**, ensure each CSPP and SPCD is consistent with Part 139.

(11) **Conduct inspections** sufficiently frequently to ensure construction contractors and tenants comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(12) **Resolve safety deficiencies immediately.** At airports subject to 49 CFR Part 1542, Airport Security, ensure construction access complies with the security requirements of that regulation.

(13) **Notify appropriate parties** when conditions exist that invoke provisions of the CSPP and SPCD (for example, implementation of low-visibility operations).

(14) **Ensure prompt submittal of a Notice of Proposed Construction or Alteration** (Form 7460-1) for conducting an aeronautical study of potential obstructions such as tall equipment (cranes, concrete pumps, other.), stock piles, and haul routes. A separate form may be filed for each potential obstruction, or one form may be filed describing the entire construction area and maximum equipment height. In the latter case, a separate form must be filed for any object beyond or higher than the originally evaluated area/height. The FAA encourages online submittal of forms for expediency. The appropriate FAA Airports Regional or District Office can provide assistance in determining which objects require an aeronautical study.

(15) **Promptly notify the FAA Airports Regional or District Office** of any proposed changes to the CSPP prior to implementation of the change. Changes to the CSPP require review and approval by the airport operator and the FAA. Coordinate with appropriate local and other federal government agencies, such as EPA, OSHA, TSA, and the state environmental agency.

c. Define Construction Contractor's Responsibilities. The contractor is responsible for complying with the CSPP and SPCD. The contractor must:

(1) **Submit a Safety Plan Compliance Document (SPCD)** to the airport operator describing how it will comply with the requirements of the CSPP and supplying any details that could not be determined before contract award. The SPCD must include a certification statement by the contractor that indicates it understands the operational safety requirements of the CSPP and it asserts it will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator. Any construction practice proposed by the contractor that does not conform to the CSPP and SPCD may impact the airport's operational safety and will require a revision to the CSPP and SPCD and re-coordination with the airport operator and the FAA in advance.

(2) **Have available at all times copies** of the CSPP and SPCD for reference by the airport operator and its representatives, and by subcontractors and contractor employees.

(3) **Ensure that construction personnel** are familiar with safety procedures and regulations on the airport. 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. Many projects will require 24-hour coverage.

(4) **Identify in the SPCD the contractor's on-site employees** responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(5) **Conduct inspections** sufficiently frequently to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(6) Restrict movement of construction vehicles and personnel to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate and as specified in the CSPP and SPCD.

(7) Ensure that no contractor employees, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) from the construction site unless authorized.

(8) Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other equipment), stock piles, and haul routes when different from cases previously filed by the airport operator. The FAA encourages online submittal of forms for expediency.

d. Define Tenant's Responsibilities if planning construction activities on leased property. Airport tenants, such as airline operators, fixed base operators, and FAA ATO/Technical Operations sponsoring construction must:

(1) Develop, or have a consultant develop, a project specific CSPP and submit it to the airport operator for certification and subsequent approval by the FAA. The approved CSPP must be made part of any contract awarded by the tenant for construction work.

(2) In coordination with its contractor, develop an SPCD and submit it to the airport operator for approval to be issued prior to issuance of a Notice to Proceed.

(3) Ensure that construction personnel are familiar with safety procedures and regulations on the airport.

(4) Provide a point of contact of who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport.

(5) Identify in the SPCD the contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(6) Ensure that no tenant or contractor employees, employees of subcontractors or suppliers, or any other persons enter any part of the AOA from the construction site unless authorized.

(7) Restrict movement of construction vehicles to construction areas by flagging and barricading, erecting temporary fencing, or providing escorts, as appropriate, and as specified in the CSPP and SPCD.

(8) Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other.), stock piles, and haul routes. The FAA encourages online submittal of forms for expediency.

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Chapter 2. Construction Safety and Phasing Plans

Section 1. Basic Considerations

201. Overview. Aviation safety is the primary consideration at airports, especially during construction. The airport operator's Construction Safety and Phasing Plan (CSPP) and the contractor's Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify all aspects of the construction project that pose a potential safety hazard to airport operations and outline respective mitigation procedures for each hazard. They must provide all information necessary for the Airport Operations department to conduct airfield inspections and expeditiously identify and correct unsafe conditions during construction. All aviation safety provisions included within the project drawings, contract specifications, and other related documents must also be reflected in the CSPP and SPCD.

202. Assume Responsibility. Operational safety on the airport remains the airport operator's responsibility at all times. The airport operator must develop, certify, and submit for FAA approval each CSPP. It is the airport operator's responsibility to apply the requirements of the FAA approved CSPP. The airport operator must revise the CSPP when conditions warrant changes and must submit the revised CSPP to the FAA for approval. The airport operator must also require and approve a SPCD from the project contractor.

203. Submit the CSPP. Construction Safety and Phasing Plans should be developed concurrently with the project design. Milestone versions of the CSPP should be submitted for review and approval as follows. While these milestones are not mandatory, early submission will help to avoid delays. Submittals are preferred in 8.5 x 11 in or 11 x 17 in format for compatibility with the FAA's Obstruction Evaluation / Airport Airspace Analysis (OE / AAA) process.

a. Submit an Outline/Draft. By the time approximately 25% to 30% of the project design is completed, the principal elements of the CSPP should be established. Airport operators are encouraged to submit an outline or draft, detailing all CSPP provisions developed to date, to the FAA for review at this stage of the project design.

b. Submit a Construction Safety and Phasing Plan (CSPP). The CSPP should be formally submitted for FAA approval when the project design is 80% to 90% complete. Since provisions in the CSPP will influence contract costs, it is important to obtain FAA approval in time to include all such provisions in the procurement contract.

c. Submit a Safety Plan Compliance Document (SPCD). The contractor should submit the SPCD to the airport operator for approval to be issued prior to the Notice to Proceed.

d. Submit CSPP Revisions. All revisions to the CSPP or SPCD should be submitted to the FAA for approval as soon as required changes are identified.

204. Meet CSPP Requirements.

a. To the extent possible, the CSPP should address the following as outlined in Section 2, Plan Requirements and Chapter 3, Guidelines for Writing a CSPP, as appropriate. Details that cannot be determined at this stage are to be included in the SPCD.

(1) Coordination.

- (a) Contractor progress meetings.
- (b) Scope or schedule changes.
- (c) FAA ATO coordination.
- (2) Phasing.**
 - (a) Phase elements.
 - (b) Construction safety drawings
- (3) Areas and operations affected by the construction activity.**
 - (a) Identification of affected areas.
 - (b) Mitigation of effects.
- (4) Protection of navigation aids (NAVAIDs).**
- (5) Contractor access.**
 - (a) Location of stockpiled construction materials.
 - (b) Vehicle and pedestrian operations.
- (6) Wildlife management.**
 - (a) Trash.
 - (b) Standing water.
 - (c) Tall grass and seeds.
 - (d) Poorly maintained fencing and gates.
 - (e) Disruption of existing wildlife habitat.
- (7) Foreign Object Debris (FOD) management.**
- (8) Hazardous materials (HAZMAT) management**
- (9) Notification of construction activities.**
 - (a) Maintenance of a list of responsible representatives/ points of contact.
 - (b) Notices to Airmen (NOTAM).
 - (c) Emergency notification procedures.
 - (d) Coordination with ARFF Personnel.
 - (e) Notification to the FAA.
- (10) Inspection requirements.**
 - (a) Daily (or more frequent) inspections.
 - (b) Final inspections.
- (11) Underground utilities.**
- (12) Penalties.**
- (13) Special conditions.**
- (14) Runway and taxiway visual aids.** Marking, lighting, signs, and visual NAVAIDs.

- (a) General.
- (b) Markings.
- (c) Lighting and visual NAVAIDs.
- (d) Signs.

(15) Marking and signs for access routes.

(16) Hazard marking and lighting.

- (a) Purpose.
- (b) Equipment.

(17) Protection. Of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces

- (a) Runway Safety Area (RSA).
- (b) Runway Object Free Area (ROFA).
- (c) Taxiway Safety Area (TSA).
- (d) Taxiway Object Free Area (TOFA).
- (e) Obstacle Free Zone (OFZ).
- (f) Runway approach/departure surfaces.

(18) Other limitations on construction.

- (a) Prohibitions.
- (b) Restrictions.

b. The Safety Plan Compliance Document (SPCD) should include a general statement by the construction contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to the contract award. The contractor statement should include the name of the contractor, the title of the project CSPP, the approval date of the CSPP, and a reference to any supplemental information (that is, “I, Name of Contractor, have read the Title of Project CSPP, approved on Date, and will abide by it as written and with the following additions as noted:”). The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary for any specific subject, the statement, “No supplemental information,” should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP:

(1) Coordination. Discuss details of proposed safety meetings with the airport operator and with contractor employees and subcontractors.

(2) Phasing. Discuss proposed construction schedule elements, including:

- (a) Duration of each phase.
- (b) Daily start and finish of construction, including “night only” construction.
- (c) Duration of construction activities during:
 - (i) Normal runway operations.
 - (ii) Closed runway operations.

(iii) Modified runway “Aircraft Reference Code” usage.

(3) **Areas and operations affected by the construction activity.** These areas and operations should be identified in the CSPP and should not require an entry in the SPCD.

(4) **Protection of NAVAIDs.** Discuss specific methods proposed to protect operating NAVAIDs.

(5) **Contractor access.** Provide the following:

(a) Details on how the contractor will maintain the integrity of the airport security fence (gate guards, daily log of construction personnel, and other).

(b) Listing of individuals requiring driver training (for certificated airports and as requested).

(c) Radio communications.

(i) Types of radios and backup capabilities.

(ii) Who will be monitoring radios.

(iii) Whom to contact if the ATCT cannot reach the contractor’s designated person by radio.

(d) Details on how the contractor will escort material delivery vehicles.

(6) **Wildlife management.** Discuss the following:

(a) Methods and procedures to prevent wildlife attraction.

(b) Wildlife reporting procedures.

(7) **Foreign Object Debris (FOD) management.** Discuss equipment and methods for control of FOD, including construction debris and dust.

(8) **Hazardous material (HAZMAT) management.** Discuss equipment and methods for responding to hazardous spills.

(9) **Notification of construction activities.** Provide the following:

(a) Contractor points of contact.

(b) Contractor emergency contact.

(c) Listing of tall or other requested equipment proposed for use on the airport and the timeframe for submitting 7460-1 forms not previously submitted by the airport operator.

(d) Batch plant details, including 7460-1 submittal.

(10) **Inspection requirements.** Discuss daily (or more frequent) inspections and special inspection procedures.

(11) **Underground utilities.** Discuss proposed methods of identifying and protecting underground utilities.

(12) **Penalties.** Penalties should be identified in the CSPP and should not require an entry in the SPCD.

(13) **Special conditions.** Discuss proposed actions for each special condition identified in the CSPP.

(14) **Runway and taxiway visual aids.** Including marking, lighting, signs, and visual NAVAIDs. Discuss proposed visual aids including the following:

- (a) Equipment and methods for covering signage and airfield lights.
- (b) Equipment and methods for temporary closure markings (paint, fabric, other).
- (c) Types of temporary Visual Guidance Slope Indicators (VGSI).

(15) Marking and signs for access routes. Discuss proposed methods of demarcating access routes for vehicle drivers.

(16) Hazard marking and lighting. Discuss proposed equipment and methods for identifying excavation areas.

(17) Protection of runway and taxiway safety areas. including object free areas, obstacle free zones, and approach/departure surfaces. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:

- (a) Equipment and methods for maintaining Taxiway Safety Area standards.
- (b) Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.

(18) Other limitations on construction should be identified in the CSPP and should not require an entry in the SPCD.

Section 2. Plan Requirements

205. Coordination. Airport operators, or tenants conducting construction on their leased properties, should use predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction (see AC 150/5300-9). In addition, the following should be coordinated as required:

a. Contractor Progress Meetings. Operational safety should be a standing agenda item for discussion during progress meetings throughout the project.

b. Scope or Schedule Changes. Changes in the scope or duration of the project may necessitate revisions to the CSPP and review and approval by the airport operator and the FAA.

c. FAA ATO Coordination. Early coordination with FAA ATO is required to schedule airway facility shutdowns and restarts. Relocation or adjustments to NAVAIDs, or changes to final grades in critical areas, may require an FAA flight inspection prior to restarting the facility. Flight inspections must be coordinated and scheduled well in advance of the intended facility restart. Flight inspections may require a reimbursable agreement between the airport operator and FAA ATO. Reimbursable agreements should be coordinated a minimum of 12 months prior to the start of construction. (See 213.e(3)(b) for required FAA notification regarding FAA owned NAVAIDs.)

206. Phasing. Once it has been determined what types and levels of airport operations will be maintained, the most efficient sequence of construction may not be feasible. In such a case, the sequence of construction may be phased to gain maximum efficiency while allowing for the required operations. The development of the resulting construction phases should be coordinated with local Air Traffic personnel and airport users. The sequenced construction phases established in the CSPP must be incorporated into the project design and must be reflected in the contract drawings and specifications.

a. Phase Elements. For each phase the CSPP should detail:

- Areas closed to aircraft operations

- Duration of closures
- Taxi routes
- ARFF access routes
- Construction staging areas
- Construction access and haul routes
- Impacts to NAVAIDs
- Lighting and marking changes
- Available runway length
- Declared distances (if applicable)
- Required hazard marking and lighting
- Lead times for required notifications

b. Construction Safety Drawings. Drawings specifically indicating operational safety procedures and methods in affected areas (that is, construction safety drawings) should be developed for each construction phase. Such drawings should be included in the CSPP as referenced attachments and should likewise be included in the contract drawing package.

207. Areas and Operations Affected by Construction Activity. Runways and taxiways should remain in use by aircraft to the maximum extent possible without compromising safety. Pre-meetings with the FAA Air Traffic Organization (ATO) will support operational simulations. See Chapter 3 for an example of a table showing temporary operations versus current operations.

a. Identification of Affected Areas. Identifying areas and operations affected by the construction will help to determine possible safety problems. The affected areas should be identified in the construction safety drawings for each construction phase. (See 206.b above.) Of particular concern are:

(1) Closing, or partial closing, of runways, taxiways and aprons. When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing, landing, or taking off in either direction on that pavement is prohibited. A displaced threshold, by contrast, is established to ensure obstacle clearance and adequate safety area for landing aircraft. The pavement prior to the displaced threshold is available for take-off in the direction of the displacement and for landing and taking off in the opposite direction. Misunderstanding this difference, and issuance of a subsequently inaccurate NOTAM, can lead to a hazardous condition.

(2) Closing of Aircraft Rescue and Fire Fighting access routes.

(3) Closing of access routes used by airport and airline support vehicles.

(4) Interruption of utilities, including water supplies for fire fighting.

(5) Approach/departure surfaces affected by heights of objects.

(6) Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads.

b. Mitigation of Effects. Establishment of specific procedures is necessary to maintain the safety and efficiency of airport operations. The CSPP must address:

(1) Temporary changes to runway and/or taxi operations.

(2) Detours for ARFF and other airport vehicles.

- (3) **Maintenance of essential utilities.**
- (4) **Temporary changes to air traffic control procedures. Such changes must be coordinated with the ATO.**

208. Navigation Aid (NAVAID) Protection. Before commencing construction activity, parking vehicles, or storing construction equipment and materials near a NAVAID, coordinate with the appropriate FAA ATO/Technical Operations office to evaluate the effect of construction activity and the required distance and direction from the NAVAID. (See paragraph 213.e(3) below.) Construction activities, materials/equipment storage, and vehicle parking near electronic NAVAIDs require special consideration since they may interfere with signals essential to air navigation. If any NAVAID may be affected, the CSPP and SPCD must show an understanding of the “critical area” associated with each NAVAID and describe how it will be protected. Where applicable, the operational critical areas of NAVAIDs should be graphically delineated on the project drawings. Pay particular attention to stockpiling material, as well as to movement and parking of equipment that may interfere with line of sight from the ATCT or with electronic emissions. Interference from construction equipment and activities may require NAVAID shutdown or adjustment of instrument approach minimums for low visibility operations. This condition requires that a NOTAM be filed (see paragraph 213.b below). Construction activities and materials/equipment storage near a NAVAID must not obstruct access to the equipment and instruments for maintenance. Submittal of a 7460-1 form is required for construction vehicles operating near FAA NAVAIDs. (See paragraph 213.e(1) below.)

209. Contractor Access. The CSPP must detail the areas to which the contractor must have access, and explain how contractor personnel will access those areas. Specifically address:

a. Location of Stockpiled Construction Materials. Stockpiled materials and equipment storage are not permitted within the RSA and OFZ, and if possible should not be permitted within the Object Free Area (OFA) of an operational runway. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval. The airport operator must ensure that stockpiled materials and equipment adjacent to these areas are prominently marked and lighted during hours of restricted visibility or darkness. (See paragraph 218.b below.) This includes determining and verifying that materials are stabilized and stored at an approved location so as not to be a hazard to aircraft operations and to prevent attraction of wildlife and foreign object damage. See paragraphs 210 and 211 below.

b. Vehicle and Pedestrian Operations. The CSPP should include specific vehicle and pedestrian requirements. Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the AOA. The airport operator should coordinate requirements for vehicle operations with airport tenants, contractors, and the FAA air traffic manager. In regard to vehicle and pedestrian operations, the CSPP should include the following, and detail associated training requirements:

(1) **Construction site parking.** Designate in advance vehicle parking areas for contractor employees to prevent any unauthorized entry of persons or vehicles onto the AOA. These areas should provide reasonable contractor employee access to the job site.

(2) **Construction equipment parking.** Contractor employees must park and service all construction vehicles in an area designated by the airport operator outside the OFZ and never in the safety area of an active runway or taxiway. Unless a complex setup procedure makes movement of specialized equipment infeasible, inactive equipment must not be parked on a closed taxiway or runway. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well lighted. Employees should also park construction vehicles outside the OFA when not in use by

construction personnel (for example, overnight, on weekends, or during other periods when construction is not active). Parking areas must not obstruct the clear line of sight by the ATCT to any taxiways or runways under air traffic control nor obstruct any runway visual aids, signs, or navigation aids. The FAA must also study those areas to determine effects on airport design criteria, surfaces established by 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (Part 77), and on NAVAIDs and Instrument Approach Procedures (IAP). See paragraph 213.e(1) below for further information.

(3) Access and haul roads. Determine the construction contractor's access to the construction sites and haul roads. Do not permit the construction contractor to use any access or haul roads other than those approved. Access routes used by contractor vehicles must be clearly marked to prevent inadvertent entry to areas open to airport operations. Pay special attention to ensure that if construction traffic is to share or cross any ARFF routes that ARFF right of way is not impeded at any time, and that construction traffic on haul roads does not interfere with NAVAIDs or approach surfaces of operational runways.

(4) Marking and lighting of vehicles in accordance with AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport.

(5) Description of proper vehicle operations on various areas under normal, lost communications, and emergency conditions.

(6) Required escorts.

(7) Training requirements for vehicle drivers to ensure compliance with the airport operator's vehicle rules and regulations. Specific training should be provided to those vehicle operators providing escorts. See AC 150/5210-20, Ground Vehicle Operations on Airports, for information on training and records maintenance requirements.

(8) Situational awareness. Vehicle drivers must confirm by personal observation that no aircraft is approaching their position (either in the air or on the ground) when given clearance to cross a runway, taxiway, or any other area open to airport operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time.

(9) Two-way radio communication procedures.

(a) General. The airport operator must ensure that tenant and construction contractor personnel engaged in activities involving unescorted operation on aircraft movement areas observe the proper procedures for communications, including using appropriate radio frequencies at airports with and without ATCT. When operating vehicles on or near open runways or taxiways, construction personnel must understand the critical importance of maintaining radio contact, as directed by the airport operator, with:

(i) Airport operations

(ii) ATCT

(iii) Common Traffic Advisory Frequency (CTAF), which may include UNICOM, MULTICOM.

(iv) Automatic Terminal Information Service (ATIS). This frequency is useful for monitoring conditions on the airport. Local air traffic will broadcast information regarding construction related runway closures and "shortened" runways on the ATIS frequency.

(b) Areas requiring two-way radio communication with the ATCT. Vehicular traffic crossing active movement areas must be controlled either by two-way radio with the ATCT, escort, flagman, signal light, or other means appropriate for the particular airport.

(c) Frequencies to be used. The airport operator will specify the frequencies to be used by the contractor, which may include the CTAF for monitoring of aircraft operations. Frequencies may also be assigned by the airport operator for other communications, including any radio frequency in compliance with Federal Communications Commission requirements. At airports with an ATCT, the airport operator will specify the frequency assigned by the ATCT to be used between contractor vehicles and the ATCT.

(d) Proper radio usage, including read back requirements.

(e) Proper phraseology, including the International Phonetic Alphabet.

(f) Light gun signals. Even though radio communication is maintained, escort vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure. See the FAA safety placard “Ground Vehicle Guide to Airport Signs and Markings.” This safety placard may be downloaded through the Runway Safety Program Web site at http://www.faa.gov/airports/runway_safety/publications/ (See “Signs & Markings Vehicle Dashboard Sticker”.) or obtained from the FAA Airports Regional Office.

(10) Maintenance of the secured area of the airport, including:

(a) Fencing and gates. Airport operators and contractors must take care to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates should be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit “piggybacking” behind another person or vehicle. The Department of Transportation (DOT) document DOT/FAA/AR-00/52, Recommended Security Guidelines for Airport Planning and Construction, provides more specific information on fencing. A copy of this document can be obtained from the Airport Consultants Council, Airports Council International, or American Association of Airport Executives.

(b) Badging requirements.

(c) Airports subject to 49 CFR Part 1542, Airport Security, must meet standards for access control, movement of ground vehicles, and identification of construction contractor and tenant personnel.

210. Wildlife Management. The CSPP and SPCD must be in accordance with the airport operator’s wildlife hazard management plan, if applicable. See also AC 150/5200-33, Hazardous Wildlife Attractants On or Near Airports, and Certalert 98-05, Grasses Attractive to Hazardous Wildlife. Construction contractors must carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel must be aware of and avoid construction activities that can create wildlife hazards on airports, such as:

a. Trash. Food scraps must be collected from construction personnel activity.

b. Standing Water.

c. Tall Grass and Seeds. Requirements for turf establishment can be at odds with requirements for wildlife control. Grass seed is attractive to birds. Lower quality seed mixtures can contain seeds of plants (such as clover) that attract larger wildlife. Seeding should comply with the guidance in AC 150/5370-10, Standards for Specifying Construction of Airports, Item T-901, Seeding. Contact the local office of the United States Department of Agriculture Soil Conservation Service or the State University Agricultural Extension Service (County Agent or equivalent) for assistance and recommendations. These agencies can also provide liming and fertilizer recommendations.

d. Poorly Maintained Fencing and Gates. See 209.b(10)(a) above.

e. Disruption of Existing Wildlife Habitat. While this will frequently be unavoidable due to the nature of the project, the CSPP should specify under what circumstances (location, wildlife type) contractor personnel should immediately notify the airport operator of wildlife sightings.

211. Foreign Object Debris (FOD) Management. Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. Construction contractors must not leave or place FOD on or near active aircraft movement areas. Materials capable of creating FOD must be continuously removed during the construction project. Fencing (other than security fencing) may be necessary to contain material that can be carried by wind into areas where aircraft operate. See AC 150/5210-24, Foreign Object Debris (FOD) Management.

212. Hazardous Materials (HAZMAT) Management. Contractors operating construction vehicles and equipment on the airport must be prepared to expeditiously contain and clean-up spills resulting from fuel or hydraulic fluid leaks. Transport and handling of other hazardous materials on an airport also requires special procedures. See AC 150/5320-15, Management of Airport Industrial Waste.

213. Notification of Construction Activities. The CSPP and SPCD must detail procedures for the immediate notification of airport users and the FAA of any conditions adversely affecting the operational safety of the airport. It must address the notification actions described below, as applicable.

a. List of Responsible Representatives/ points of contact for all involved parties, and procedures for contacting each of them, including after hours.

b. NOTAMs. Only the airport operator may initiate or cancel NOTAMs on airport conditions, and is the only entity that can close or open a runway. The airport operator must coordinate the issuance, maintenance, and cancellation of NOTAMs about airport conditions resulting from construction activities with tenants and the local air traffic facility (control tower, approach control, or air traffic control center), and must provide information on closed or hazardous conditions on airport movement areas to the FAA Flight Service Station (FSS) so it can issue a NOTAM. The airport operator must file and maintain a list of authorized representatives with the FSS. Refer to AC 150/5200-28, Notices to Airmen (NOTAMs) for Airport Operators, for a sample NOTAM form. Only the FAA may issue or cancel NOTAMs on shutdown or irregular operation of FAA owned facilities. Any person having reason to believe that a NOTAM is missing, incomplete, or inaccurate must notify the airport operator. See paragraph 207.a(1) above regarding issuing NOTAMs for partially closed runways versus runways with displaced thresholds.

c. Emergency notification procedures for medical, fire fighting, and police response.

d. Coordination with ARFF. The CSPP must detail procedures for coordinating through the airport sponsor with ARFF personnel, mutual aid providers, and other emergency services if construction requires:

- The deactivation and subsequent reactivation of water lines or fire hydrants, or
- The rerouting, blocking and restoration of emergency access routes, or
- The use of hazardous materials on the airfield.

e. Notification to the FAA.

(1) Part 77. Any person proposing construction or alteration of objects that affect navigable airspace, as defined in Part 77, must notify the FAA. This includes construction equipment and proposed

parking areas for this equipment (i.e. cranes, graders, other equipment) on airports. FAA Form 7460-1, Notice of Proposed Construction or Alteration, can be used for this purpose and submitted to the appropriate FAA Airports Regional or District Office. See Appendix 1, Related Reading Material, to download the form. Further guidance is available on the FAA web site at oeaaa.faa.gov.

(2) Part 157. With some exceptions, Title 14 CFR Part 157, Notice of Construction, Alteration, Activation, and Deactivation of Airports, requires that the airport operator notify the FAA in writing whenever a non-Federally funded project involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport. Notification involves submitting FAA Form 7480-1, Notice of Landing Area Proposal, to the nearest FAA Airports Regional or District Office. See Appendix 1, Related Reading Material to download the form.

(3) NAVAIDS. For emergency (short-notice) notification about impacts to both airport owned and FAA owned NAVAIDs, contact: 866-432-2622.

(a) Airport owned/FAA maintained. If construction operations require a shutdown of more than 24 hours, or more than 4 hours daily on consecutive days, of a NAVAID owned by the airport but maintained by the FAA, provide a 45-day minimum notice to FAA ATO/Technical Operations prior to facility shutdown.

(b) FAA owned.

(i) General. The airport operator must notify the appropriate FAA ATO Service Area Planning and Requirements (P&R) Group a minimum of 45 days prior to implementing an event that causes impacts to NAVAIDs. (Impacts to FAA equipment covered by a Reimbursable Agreement (RA) do not have to be reported by the airport operator.)

(ii) Coordinate work for an FAA owned NAVAID shutdown with the local FAA ATO/Technical Operations office, including any necessary reimbursable agreements and flight checks. Detail procedures that address unanticipated utility outages and cable cuts that could impact FAA NAVAIDs. In addition, provide seven days notice to schedule the actual shutdown.

214. Inspection Requirements.

a. Daily Inspections. Inspections should be conducted at least daily, but more frequently if necessary to ensure conformance with the CSPP. A sample checklist is provided in Appendix 3, Safety and Phasing Plan Checklist. See also AC 150/5200-18, Airport Safety Self-Inspection.

b. Final Inspections. New runways and extended runway closures may require safety inspections at certificated airports prior to allowing air carrier service. Coordinate with the FAA Airport Certification Safety Inspector (ACSI) to determine if a final inspection will be necessary.

215. Underground Utilities. The CSPP and/or SPCD must include procedures for locating and protecting existing underground utilities, cables, wires, pipelines, and other underground facilities in excavation areas. This may involve coordinating with public utilities and FAA ATO/Technical Operations. Note that “One Call” or “Miss Utility” services do not include FAA ATO/Technical Operations

216. Penalties. The CSPP should detail penalty provisions for noncompliance with airport rules and regulations and the safety plans (for example, if a vehicle is involved in a runway incursion). Such penalties typically include rescission of driving privileges or access to the AOA.

217. Special Conditions. The CSPP must detail any special conditions that affect the operation of the

airport and will require the activation of any special procedures (for example, low-visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, Vehicle / Pedestrian Deviation (VPD) and other activities requiring construction suspension/resumption).

218. Runway and Taxiway Visual Aids. Includes marking, lighting, signs, and visual NAVAIDS. The CSPP must ensure that areas where aircraft will be operating are clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs, and visual NAVAIDS remain in place and operational. The CSPP must address the following, as appropriate:

a. General. Airport markings, lighting, signs, and visual NAVAIDS must be clearly visible to pilots, not 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.

b. Markings. Markings must be in compliance with the standards of AC 150/5340-1, Standards for Airport Markings. Runways and runway exit taxiways closed to aircraft operations are marked with a yellow X. The preferred visual aid to depict temporary runway closure is the lighted X signal placed on or near the runway designation numbers. (See paragraph 218.b(1)(b) below.)

(1) Closed Runways and Taxiways.

(a) **Permanently Closed Runways.** For runways, obliterate the threshold marking, runway designation marking, and touchdown zone markings, and place Xs at each end and at 1,000-foot (300 m) intervals.

(b) **Temporarily Closed Runways.** For runways that have been temporarily closed, place an X at the each end of the runway directly on or as near as practicable to the runway designation numbers. Figure 2-1 illustrates.



Figure 2-1 Markings for a Temporarily Closed Runway

(c) **Partially Closed Runways and Displaced Thresholds.** When threshold markings are needed to identify the temporary beginning of the runway that is available for landing, the markings must comply with AC 150/5340-1. An X is not used on a partially closed runway or a runway with a displaced threshold. See paragraph 207.a(1) above for the difference between partially closed runways and runways with displaced thresholds.

(i) **Partially Closed Runways.** Pavement markings for temporary closed portions of the runway consist of a runway threshold bar and yellow chevrons to identify pavement areas that are unsuitable for takeoff or landing (see AC 150/5340-1).

(ii) **Displaced Thresholds.** Pavement markings for a displaced threshold consist of a runway threshold bar and white arrowheads with and without arrow shafts. These markings are required to identify the portion of the runway before the displaced threshold to provide centerline guidance for pilots during approaches, takeoffs, and landing rollouts from the opposite direction. See AC 150/5340-1.

(d) Taxiways.

(i) Permanently Closed Taxiways. AC 150/5300-13 notes that it is preferable to remove the pavement, but for pavement that is to remain, place an X at the entrance to both ends of the closed section. Obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed taxiway. Figure 2-2 illustrates.

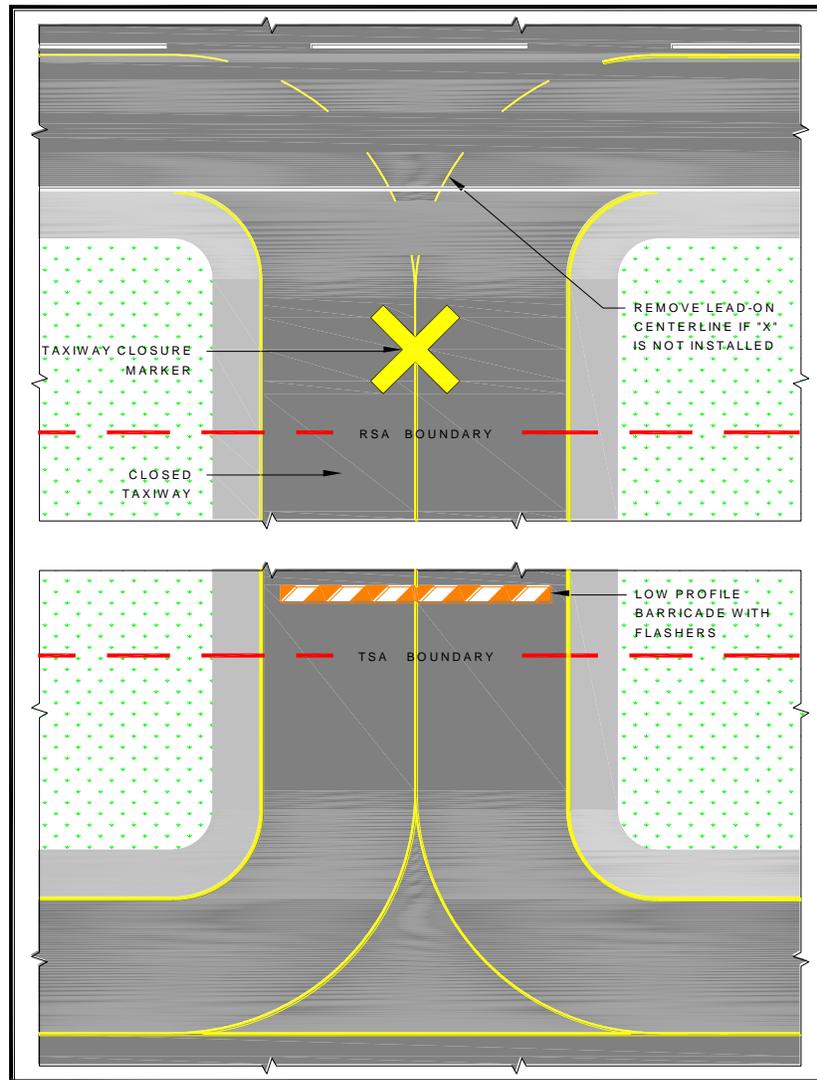


Figure 2-2 Taxiway Closure

(ii) Temporarily Closed Taxiways. Place barricades outside the safety area of intersecting taxiways. For runway/taxiway intersections, place an X at the entrance to the closed taxiway from the runway. If the taxiway will be closed for an extended period, obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed section. If the centerline markings will be reused upon reopening the taxiway, it is preferable to paint over the marking. This will result in less damage to the pavement when the upper layer of paint is ultimately removed.

(e) Temporarily Closed Airport. When the airport is closed temporarily, mark all the runways as closed.

(2) If unable to paint temporary markings on the pavement, construct them from any of the following materials: fabric, colored plastic, painted sheets of plywood, or similar materials. They must be properly configured and appropriately secured to prevent movement by prop wash, jet blast, or other wind currents.

(3) It may be necessary to remove or cover runway markings, including but not limited to, runway designation markings, threshold markings, centerline markings, edge stripes, touchdown zone markings and aiming point markings, depending on the length of construction and type of activity at the airport. When removing runway markings, apply the same treatment to areas between stripes or numbers, as the cleaned area will appear to pilots as a marking in the shape of the treated area.

(4) If it is not possible to install threshold bars, chevrons, and arrows on the pavement, temporary outboard markings may be used. Locate them outside of the runway pavement surface on both sides of the runway. The dimension along the runway direction must be the same as if installed on the pavement. The lateral dimension must be at least one-half that of on-pavement markings. If the markings are not discernible on grass or snow, apply a black background with appropriate material over the ground to ensure they are clearly visible.

(5) The application rate of paint to mark a short-term temporary runway and taxiway markings may deviate from the standard (see Item P-620, "Runway and Taxiway Painting," in AC 150/5370-10), but the dimensions must meet the existing standards.

c. Lighting and Visual NAVAIDs. This paragraph refers to standard runway and taxiway lighting systems. See below for hazard lighting. Lighting must be in conformance with AC 150/5340-30, Design and Installation Details for Airport Visual Aids, and AC 150/5345-50, Specification for Portable Runway and Taxiway Lights. When disconnecting runway and taxiway lighting fixtures, disconnect the associated isolation transformers. Alternately, cover the light fixture in such a way as to prevent light leakage. Avoid removing the lamp from energized fixtures because an excessive number of isolation transformers with open secondaries may damage the regulators and/or increase the current above its normal value. Secure, identify, and place any above ground temporary wiring in conduit to prevent electrocution and fire ignition sources.

(1) Permanently Closed Runways and Taxiways. For runways and taxiways that have been permanently closed, disconnect the lighting circuits.

(2) **Temporarily Closed Runways.** If available, use a lighted X, both at night and during the day, placed at each end of the runway facing the approach. The use of a lighted X is required if night work requires runway lighting to be on. See AC 150/5345-55, Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure. For runways that have been temporarily closed, but for an extended period, and for those with pilot controlled lighting, disconnect the lighting circuits or secure switches to prevent inadvertent activation. For runways that will be opened periodically, coordinate procedures with the FAA air traffic manager or, at airports without an ATCT, the airport operator. Activate stop bars if available. Figure 2-3 shows a lighted X by day. Figure 2-4 shows a lighted X at night.



Figure 2-3 Lighted X in Daytime



Figure 2-4 Lighted X at Night

(3) **Partially Closed Runways and Displaced Thresholds.** When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing and landing or

taking off in either direction. A displaced threshold, by contrast, is put in place to ensure obstacle clearance by landing aircraft. The pavement prior to the displaced threshold is available for takeoff in the direction of the displacement, and for landing and takeoff in the opposite direction. Misunderstanding this difference and issuance of a subsequently inaccurate NOTAM can result in a hazardous situation. For both partially closed runways and displaced thresholds, approach lighting systems at the affected end must be placed out of service

(a) **Partially Closed Runways.** Disconnect edge and threshold lights on that part of the runway at and behind the threshold (that is, the portion of the runway that is closed). Alternately, cover the light fixture in such a way as to prevent light leakage.

(b) **Displaced Thresholds.** Edge lighting in the area of the displacement emits red light in the direction of approach and yellow light in the opposite direction. Centerline lights are blanked out in the direction of approach if the displacement is 700 ft or less. If the displacement is over 700 ft, place the centerline lights out of service. See AC 150/5340-30 for details on lighting displaced thresholds.

(c) Temporary runway thresholds and runway ends must be lighted if the runway is lighted and it is the intended threshold for night landings or instrument meteorological conditions.

(d) A temporary threshold on an unlighted runway may be marked by retroreflective, elevated markers in addition to markings noted in paragraph 218.b(1)(c) above. Markers seen by aircraft on approach are green. Markers at the rollout end of the runway are red. At certificated airports, temporary elevated threshold markers must be mounted with a frangible fitting (see 14 CFR Part 139.309). At non-certificated airports, the temporary elevated threshold markings may either be mounted with a frangible fitting or be flexible. See AC 150/5345-39, Specification for L-853, Runway and Taxiway Retroreflective Markers.

(e) Temporary threshold lights and end lights and related visual NAVAIDs are installed outboard of the edges of the full-strength pavement only when they cannot be installed on the pavement. They are installed with bases at grade level or as low as possible, but not more than 3 in (7.6 cm) above ground. When any portion of a base is above grade, place properly compacted fill around the base to minimize the rate of gradient change so aircraft can, in an emergency, cross at normal landing or takeoff speeds without incurring significant damage. See AC 150/5370-10.

(f) Maintain threshold and edge lighting color and spacing standards as described in AC 150/5340-30. Battery powered, solar, or portable lights that meet the criteria in AC 150/5345-50 may be used. These systems are intended primarily for visual flight rules (VFR) aircraft operations but may be used for instrument flight rules (IFR) aircraft operations, upon individual approval from the Flight Standards Division of the applicable FAA Regional Office.

(g) Reconfigure yellow lenses (caution zone), as necessary. If the runway has centerline lights, reconfigure the red lenses, as necessary, or place the centerline lights out of service.

(h) Relocate the visual glide slope indicator (VGSI), such as VASI and PAPI; other airport lights, such as Runway End Identifier Lights (REIL); and approach lights to identify the temporary threshold. Another option is to disable the VGSI or any equipment that would give misleading indications to pilots as to the new threshold location. Installation of temporary visual aids may be necessary to provide adequate guidance to pilots on approach to the affected runway. If the FAA owns and operates the VGSI, coordinate its installation or disabling with the local ATO/Technical Operations Office. Relocation of such visual aids will depend on the duration of the project and the benefits gained from the relocation, as this can result in great expense.

(i) Issue a NOTAM to inform pilots of temporary lighting conditions.

(4) Temporarily Closed Taxiways. If possible, deactivate the taxiway lighting circuits. When deactivation is not possible (for example other taxiways on the same circuit are to remain open),

cover the light fixture in such a way as to prevent light leakage.

d. Signs. To the extent possible, signs must be in conformance with AC 150/5345-44, Specification for Runway and Taxiway Signs and AC 150/5340-18, Standard for Airport Sign Systems. Any time a sign does not serve its normal function; it must be covered or removed to prevent misdirecting pilots. Note that information signs identifying a crossing taxiway continue to perform their normal function even if the crossing taxiway is closed. For long term construction projects, consider relocating signs, especially runway distance remaining signs.

219. Marking and Signs for Access Routes. The CSPP should indicate that 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. Signs adjacent to areas used by aircraft must comply with the frangibility requirements of AC 150/5220-23, Frangible Connections, which may require modification to size and height guidance in the MUTCD.

220. Hazard Marking, Lighting and Signing.

a. Hazard Marking and Lighting Prevents Pilots from entering areas closed to aircraft, and prevents construction personnel from entering areas open to aircraft. The CSPP must specify prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles. Hazard marking and lighting must also be specified to identify open manholes, small areas under repair, stockpiled material, waste areas, and areas subject to jet blast. Also consider less obvious construction-related hazards and include markings to identify FAA, airport, and National Weather Service facilities cables and power lines; instrument landing system (ILS) critical areas; airport surfaces, such as RSA, OFA, and OFZ; and other sensitive areas to make it easier for contractor personnel to avoid these areas.

b. Equipment.

(1) Barricades, including traffic cones, (weighted or sturdily attached to the surface) are acceptable methods used to identify and define the limits of construction and hazardous areas on airports. Careful consideration must be given to selecting equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast. The spacing of barricades must be such that a breach is physically prevented barring a deliberate act. For example, if barricades are intended to exclude vehicles, gaps between barricades must be smaller than the width of the excluded vehicles, generally 4 ft. Provision must be made for ARFF access if necessary. If barricades are intended to exclude pedestrians, they must be continuously linked. Continuous linking may be accomplished through the use of ropes, securely attached to prevent FOD.

(2) Lights must be red, either steady burning or flashing, and must meet the luminance requirements of the State Highway Department. Batteries powering lights will last longer if lights flash. Lights must be mounted on barricades and spaced at no more than 10 ft. Lights must be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations. They may be operated by photocell, but this may require that the contractor turn them on manually during periods of low visibility during daytime hours.

(3) Supplement barricades with signs (for example “No Entry,” “No Vehicles”) as necessary.

(4) Air Operations Area – General. Barricades are not permitted in any active safety area. Within a runway or taxiway object free area, and on aprons, use orange traffic cones, flashing or steady burning red lights as noted above, collapsible barricades marked with diagonal, alternating orange and

white stripes; and/or signs to separate all construction/maintenance areas from the movement area. Barricades may be supplemented with alternating orange and white flags at least 20 by 20 in (50 by 50 cm) square and securely fastened to eliminate FOD. All barricades adjacent to any open runway or taxiway / taxilane safety area, or apron must be as low as possible to the ground, and no more than 18 in high, exclusive of supplementary lights and flags. Barricades must be of low mass; easily collapsible upon contact with an aircraft or any of its components; and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents. If affixed to the surface, they must be frangible at grade level or as low as possible, but not to exceed 3 in (7.6 cm) above the ground. Figure 2-5 and Figure 2-6 show sample barricades with proper coloring and flags.



Figure 2-5 Interlocking Barricades



Figure 2-6 Low Profile Barricades

(5) Air Operations Area – Runway/Taxiway Intersections. Use highly reflective barricades with lights to close taxiways leading to closed runways. Evaluate all operating factors when determining how to mark temporary closures that can last from 10 to 15 minutes to a much longer period of time. However, even for closures of relatively short duration, close all taxiway/runway intersections with barricades. The use of traffic cones is appropriate for short duration closures.

(6) Air Operations Area – Other. Beyond runway and taxiway object free areas and

aprons, barricades intended for construction vehicles and personnel may be many different shapes and made from various materials, including railroad ties, sawhorses, jersey barriers, or barrels.

(7) **Maintenance.** The construction specifications must include a provision requiring the contractor to have a person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The contractor must file the contact person's information with the airport operator. Lighting should be checked for proper operation at least once per day, preferably at dusk.

221. Protection of Runway and Taxiway Safety Areas. Runway and taxiway safety areas, Obstacle Free zones (OFZ), object free areas (OFA), and approach surfaces are described in AC 150/5300-13. Protection of these areas includes limitations on the location and height of equipment and stockpiled material. An FAA airspace study may be required. Coordinate with the appropriate FAA Airports Regional or District Office if there is any doubt as to requirements or dimensions (See paragraph 213.e above.) as soon as the location and height of materials or equipment are known. The CSPP should include drawings showing all safety areas, object free areas, obstacle free zones and approach departure surfaces affected by construction.

a. Runway Safety Area (RSA). 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 (see AC 150/5300-13). Construction activities within the existing RSA are subject to the following conditions:

(1) **No construction may occur within the existing RSA** while the runway is open for aircraft operations. The RSA dimensions may be temporarily adjusted if the runway is restricted to aircraft operations requiring an RSA that is equal to the RSA width and length beyond the runway ends available during construction. (see AC 150/5300-13). The temporary use of declared distances and/or partial runway closures may provide the necessary RSA under certain circumstances. Coordinate with the appropriate FAA Airports Regional or District Office to have declared distances information published. See AC 150/5300-13 for guidance on the use of declared distances.

(2) **The airport operator must coordinate** the adjustment of RSA dimensions as permitted above with the appropriate FAA Airports Regional or District Office and the local FAA air traffic manager and issue a NOTAM.

(3) **The CSPP and SPCD must provide procedures** for ensuring adequate distance for protection from blasting operations, if required by operational considerations.

(4) **Excavations.**

(a) Open trenches or excavations are not permitted within the RSA while the runway is open. If possible, backfill trenches before the runway is opened. If the runway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the runway across the trench without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations at the construction 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.

(5) **Erosion Control.** Soil erosion must be controlled to maintain RSA standards, that is, the RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

b. 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. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval.

c. Taxiway Safety Area (TSA). 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. (See AC 150/5300-13.) Construction activities within the TSA are subject to the following conditions:

(1) **No construction may occur** within the TSA while the taxiway is open for aircraft operations. The TSA dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a TSA that is equal to the TSA width available during construction (see AC 150/5300-13, Table 4-1).

(2) **The airport operator must coordinate** the adjustment of the TSA width as permitted above with the appropriate FAA Airports Regional or District Office and the FAA air traffic manager and issue a NOTAM.

(3) **The CSPP and SPCD must provide procedures** for ensuring adequate distance for protection from blasting operations.

(4) **Excavations.**

(a) Open trenches or excavations are not permitted within the TSA while the taxiway is open. If possible, backfill trenches before the taxiway is opened. If the taxiway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway across the trench without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations at the construction 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.

(5) **Erosion Control.** Soil erosion must be controlled to maintain TSA standards, that is, the 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 snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

d. 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 taxiway object free area while the taxiway is open for aircraft operations.

(1) **The taxiway object free area dimensions** may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a taxiway object free area that is equal to the taxiway object free area width available.

(2) **Offset taxiway pavement markings** may be used as a temporary measure to provide the required taxiway object free area. Where offset taxiway pavement markings are provided, centerline lighting or reflectors are required.

(3) **Construction activity may be accomplished** without adjusting the width of the taxiway object free area, subject to the following restrictions:

- (a) Appropriate NOTAMs are issued.
- (b) Marking and lighting meeting the provisions of paragraphs 218 and 220 above are implemented.
- (c) Five-foot clearance is maintained between equipment and materials and any part of an aircraft (includes wingtip overhang). In these situations, flaggers must be used to direct construction equipment, and wing walkers will be necessary to guide aircraft. Wing walkers should be airline/aviation personnel rather than construction workers. If such clearance can only be maintained if an aircraft does not have full use of the entire taxiway width (with its main landing gear at the edge of the pavement), then it will be necessary to move personnel and equipment for the passage of that aircraft.

e. 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. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

f. Runway Approach/Departure Areas and Clearways. All personnel, materials, and/or equipment must remain clear of the applicable threshold siting surfaces, as defined in Appendix 2, "Threshold Siting Requirements," of AC 150/5300-13. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

(1) Construction activity in a runway approach/departure area may result in the need to partially close a runway or displace the existing runway threshold. Partial runway closure, displacement of the runway threshold, as well as closure of the complete runway and other portions of the movement area also require coordination through the airport operator with the appropriate FAA air traffic manager (FSS if non-towered) and ATO/Technical Operations (for affected NAVAIDS) and airport users.

(2) Caution regarding partial runway closures. When filing a NOTAM for a partial runway closure, clearly state to OCC personnel that the portion of pavement located prior to the threshold is not available for landing and departing traffic. In this case, the threshold has been moved for both landing and takeoff purposes (this is different than a displaced threshold). There may be situations where the portion of closed runway is available for taxiing only. If so, the NOTAM must reflect this condition).

(3) Caution regarding displaced thresholds. : Implementation of a displaced threshold affects runway length available for aircraft landing over the displacement. Depending on the reason for the displacement (to provide obstruction clearance or RSA), such a displacement may also require an adjustment in the landing distance available and accelerate-stop distance available in the opposite direction. If project scope includes personnel, equipment, excavation, other work. within the existing RSA of any usable runway end, do not implement a displaced threshold unless arrivals and departures toward the construction activity are prohibited. Instead, implement a partial closure.

222. Other Limitations on Construction. The CSPP must specify any other limitations on construction, including but not limited to:

a. Prohibitions.

(1) No use of tall equipment (cranes, concrete pumps, and so on) unless a 7460-1 determination letter is issued for such equipment.

(2) No use of open flame welding or torches unless fire safety precautions are provided and the airport operator has approved their use.

(3) No use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.

See AC 150/5370-10.

(4) No use of flare pots within the AOA.

b. Restrictions.

(1) Construction suspension required during specific airport operations.

(2) Areas that cannot be worked on simultaneously.

(3) Day or night construction restrictions.

(4) Seasonal construction restrictions.

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Chapter 3. Guidelines for Writing a CSPP

301. General Requirements. The CSPP is a standalone document written to correspond with the subjects outlined in Chapter 2, Section 1, paragraph 204. The CSPP is organized by numbered sections corresponding to each subject listed in Chapter 2, Section 1, paragraph 204, and described in detail in Chapter 2, Section 2. Each section number and title in the CSPP matches the corresponding subject outlined in Chapter 2, paragraph 204 (for example, 1. Coordination, 2. Phasing, 3. Areas and Operations Affected by the Construction Activity, and so on.). With the exception of the project scope of work outlined in Section 2. Phasing, only subjects specific to operational safety during construction should be addressed.

302. Applicability of Subjects. Each section should, to the extent practical, focus on the specific subject. Where an overlapping requirement spans several sections, the requirement should be explained in detail in the most applicable section. A reference to that section should be included in all other sections where the requirement may apply. For example, the requirement to protect existing underground FAA Instrument Landing System (ILS) cables during trenching operations could be considered FAA ATO coordination (Section 1. Coordination, paragraph 205.c), an area and operation affected by the construction activity (Section 3. Areas and Operations Affected by the Construction Activity, paragraph 207.a(4)), a protection of a NAVAID (Section 4. Protection of Navigational Aids (NAVAIDs), paragraph 208), or a notification to the FAA of construction activities (Section 9. Notification of Construction Activities, paragraph 210.e(3)(b)). However, it is more specifically an underground utility requirement (Section 11. Underground Utilities, paragraph 215). The procedure for protecting underground ILS cables during trenching operations should therefore be described in Section 11: *“The contractor must coordinate with the local FAA System Support Center (SSC) to mark existing ILS cable routes along Runway 17-35. The ILS cables will be located by hand digging whenever the trenching operation moves within 10 feet of the cable markings.”* All other applicable sections should include a reference to Section 11: *“ILS cables shall be identified and protected as described in Section 11”* or *“See Section 11 for ILS cable identification and protection requirements.”* Thus, the CSPP should be considered as a whole, with no need to duplicate responses to related issues.

303. Graphical Representations. Construction safety drawings should be included in the CSPP as attachments. When other graphical representations will aid in supporting written statements, the drawings, diagrams, and/or photographs should also be attached to the CSPP. References should be made in the CSPP to each graphical attachment and may be made in multiple sections.

304. Reference Documents. The CSPP must not incorporate a document by reference unless reproduction of the material in that document is prohibited. In that case, either copies of or a source for the referenced document must be provided to the contractor.

305. Restrictions. The CSPP should not be considered as a project design review document. The CSPP should also avoid mention of permanent (“as-built”) features such as pavements, markings, signs, and lighting, except when such features are intended to aid in maintaining operational safety during the construction.

306. Coordination. Include in this section a detailed description of conferences and meetings both before and during the project. Include appropriate information from AC 150/5300-9. Discuss coordination procedures and schedules for each required FAA ATO airway facility shutdown and restart and all required flight inspections.

307. Phasing. Include in this section a detailed scope of work description for the project as a whole and each phase of work covered by the CSPP. This includes all locations and durations of the work proposed. Attach drawings to graphically support the written scope of work. Detail in this section the sequenced phases of the proposed construction. Include a reference to paragraph 308 below, as appropriate.

308. Areas and Operations Affected By Construction. Focus in this section on identifying the areas and operations affected by the construction. Describe corresponding mitigation that is not covered in detail elsewhere in the CSPP. Include references to paragraphs below as appropriate. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed. Tables and charts such as the following may be helpful in highlighting issues to be addressed.

Table 3-1 Sample Operations Effects

| Project | Runway 15-33 Reconstruction | |
|---|--|---|
| Phase | Phase II: Reconstruct Runway 15 End | |
| Scope of Work | Reconstruct 1,000 ft of north end of Runway 15-33 with Portland Cement Concrete (PCC). | |
| Operational Requirements | Normal (Existing) | Phase II (Anticipated) |
| Runway 15 Average Aircraft Operations | Carrier: 52 /day GA: 26 /day Military: 11 /day | Carrier: 52 / day GA: 20 / day Military: 0 /day |
| Runway 33 Average Aircraft Operations | Carrier: 40 /day GA: 18 /day Military: 10 /day | Carrier: 20 /day GA: 5 /day Military: 0 /day |
| Runway 15-33 ARC | C-IV | C-IV |
| Runway 15 Approach Visibility Minimums | ¾ mile | 1 mile |
| Runway 33 Approach Visibility Minimums | ¾ mile | 1 mile |
| Runway 15 Declared Distances | TORA: 7,820 | TORA: 6,420 |
| | TODA: 7,820 | TODA: 6,420 |
| | ASDA: 7,820 | ASDA: 6,420 |
| | LDA: 7,820 | LDA: 6,420 |
| Runway 33 Declared Distances | TORA: 8,320 | TORA: 6,920 |
| | TODA: 8,320 | TODA: 6,920 |
| | ASDA: 8,320 | ASDA: 6,920 |
| | LDA: 7,820 | LDA: 6,420 |
| Runway 15 Approach Procedures | ILS | LOC only |
| | RNAV | N/A |
| | VOR | N/A |
| Runway 33 Approach Procedures | ILS | Visual only |
| | RNAV | N/A |
| | VOR | N/A |
| Runway 15 NAVAIDs | ILS/DME, MALSR, RVR | LOC/DME, PAPI (temp), RVR |

| | | |
|---------------------------|--|---|
| Runway 33 NAVAIDs | ILS/DME, MALSF, PAPI, RVR | MALSF, PAPI, RVR |
| Taxiway G ADG | IV | IV (N/A between T/W H and R/W 15 end) |
| Taxiway E ADG | IV | IV |
| ATCT (hours open) | 06:00 – 24:00 local | 06:00 – 24:00 local |
| ARFF Index | D | D |
| Special Conditions | Air National Guard (ANG) military operations | Military operations relocated to alternate ANG Base |
| | Airline XYZ requires VGSI | Airline XYZ requires VGSI |

Complete the following chart for each phase to determine the area that must be protected along the runway edges:

| Runway | Aircraft Approach Category* A, B, C, or D | Airplane Design Group* I, II, III, or IV | RSA Width in Feet Divided by 2* |
|--------|--|---|------------------------------------|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

*See AC 150/5300-13 to complete the chart for a specific runway.

Complete the following chart for each phase to determine the area that must be protected before the runway threshold:

| Runway End Number | Airplane Design Group* I, II, III, or IV | Aircraft Approach Category* A, B, C, or D | Minimum Safety Area Prior to the Threshold* | Minimum Distance to Threshold Based on Required Approach Slope* | |
|-------------------|---|--|--|---|----------|
| _____ | _____ | _____ | _____ ft | _____ ft | _____: 1 |
| _____ | _____ | _____ | _____ ft | _____ ft | _____: 1 |
| _____ | _____ | _____ | _____ ft | _____ ft | _____: 1 |
| _____ | _____ | _____ | _____ ft | _____ ft | _____: 1 |

*See AC 150/5300-13 to complete the chart for a specific runway.

309. Navigation Aid (NAVAID) Protection. List in this section all NAVAID facilities that will be affected by the construction. Identify NAVAID facilities that will be placed out of service at any time prior to or during construction activities. Identify individuals responsible for coordinating each shutdown and when each facility will be out of service. Include a reference to paragraph 306 above for FAA ATO NAVAID shutdown, restart, and flight inspection coordination. Outline in detail procedures to protect each NAVAID facility remaining in service from interference by construction activities. Include a reference to paragraph 314 for the issuance of NOTAMs as required. Include a reference to paragraph 316 for the protection of underground cables and piping serving NAVAIDs. If temporary visual aids are proposed to replace or supplement existing facilities, include a reference to paragraph 319. Attach drawings to graphically indicate the affected NAVAIDS and the corresponding critical areas.

310. Contractor Access. This will necessarily be the most extensive section of the CSPP. Provide

sufficient detail so that a contractor not experienced in working on airports will understand the unique restrictions such work will require. Due to this extent, it should be broken down into subsections as described below:

a. Location of Stockpiled Construction Materials. Describe in this section specific locations for stockpiling material. Note any height restrictions on stockpiles. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify stockpiles. Include a reference to paragraph 311 for provisions to prevent stockpile material from becoming wildlife attractants. Include a reference to paragraph 312 for provisions to prevent stockpile material from becoming FOD. Attach drawings to graphically indicate the stockpile locations.

b. Vehicle and Pedestrian Operations. While there are many items to be addressed in this major subsection of the CSPP, all are concerned with one main issue: keeping people and vehicles from areas of the airport where they don't belong. This includes preventing unauthorized entry to the AOA and preventing the improper movement of pedestrians or vehicles on the airport. In this section, focus on mechanisms to prevent construction vehicles and workers traveling to and from the worksite from unauthorized entry into movement areas. Specify locations of parking for both employee vehicles and construction equipment, and routes for access and haul roads. In most cases, this will best be accomplished by attaching a drawing. Quote from AC 150/5210-5 specific requirements for contractor vehicles rather than referring to the AC as a whole, and include special requirements for identifying Hazardous Material (HAZMAT) vehicles. Quote from, rather than incorporate by reference, AC 150/5210-20 as appropriate to address the airport's rules for ground vehicle operations, including its training program. Discuss the airport's recordkeeping system listing authorized vehicle operators.

c. Two-Way Radio Communications. Include a special section to identify all individuals who are required to maintain communications with Air Traffic (AT) at airports with active towers, or monitor Common Traffic Advisory Frequencies (CTAF) at airports without or with closed ATCT. Include training requirements for all individuals required to communicate with AT. Individuals required to monitor AT frequencies should also be identified. If construction employees are also required to communicate by radio with Airport Operations, this procedure should be described in detail. Usage of vehicle mounted radios and/or portable radios should be addressed. Communication procedures for the event of disabled radio communication (that is, light signals, telephone numbers, others) must be included. All radio frequencies should be identified (Tower, Ground Control, CTAF, UNICOM, ATIS, and so on).

d. Airport Security. Address security as it applies to vehicle and pedestrian operations. Discuss TSA requirements, security badging requirements, perimeter fence integrity, gate security, and other needs. Attach drawings to graphically indicate secured and/or Security Identification Display Areas (SIDA), perimeter fencing, and available access points.

311. Wildlife Management. Discuss in this section wildlife management procedures. Describe the maintenance of existing wildlife mitigation devices, such as perimeter fences, and procedures to limit wildlife attractants. Include procedures to notify Airport Operations of wildlife encounters. Include a reference to paragraph 310 for security (wildlife) fence integrity maintenance as required.

312. Foreign Object Debris (FOD) Management. In this section, discuss methods to control and monitor FOD: worksite housekeeping, ground vehicle tire inspections, runway sweeps, and so on. Include a reference to paragraph 315 for inspection requirements as required.

313. Hazardous Materials (HAZMAT) Management. Describe in this section HAZMAT management procedures: fuel deliveries, spill recovery procedures, Material Safety Data Sheet (MSDS) availability, and other considerations. Any specific airport HAZMAT restrictions should also be

identified. Include a reference to paragraph 310 for HAZMAT vehicle identification requirements. Quote from, rather than incorporate by reference, AC 150/5320-15.

314. Notification of Construction Activities. List in this section the names and telephone numbers of points of contact for all parties affected by the construction project. We recommend a single list that includes all telephone numbers required under this section. Include emergency notification procedures for all representatives of all parties potentially impacted by the construction. Identify individual representatives – and at least one alternate – for each party. List both on-duty and off-duty contact information for each individual, including individuals responsible for emergency maintenance of airport construction hazard lighting and barricades. Describe procedures to coordinate immediate response to events that might adversely affect the operational safety of the airport (such as interrupted NAVAID service). Explain requirements for and the procedures for the issuance of Notices to Airmen (NOTAMs), notification to FAA required by 14 CFR Part 77 and Part 157 and in the event of affected NAVAIDs. For NOTAMs, identify an individual, and at least one alternate, responsible for issuing and cancelling each specific type of Notice to Airmen (NOTAM) required. Detail notification methods for police, fire fighting, and medical emergencies. This may include 911, but should also include direct phone numbers of local police departments and nearby hospitals. The local Poison Control number should be listed. Procedures regarding notification of Airport Operations and/or the ARFF Department of such emergencies should be identified, as applicable. If airport radio communications are identified as a means of emergency notification, include a reference to paragraph 310. Differentiate between emergency and nonemergency notification of ARFF personnel, the latter including activities that affect ARFF water supplies and access roads. Identify the primary ARFF contact person and at least one alternate. If notification is to be made through Airport Operations, then detail this procedure. Include a method of confirmation from the ARFF department.

315. Inspection Requirements. Describe in this section inspection requirements to ensure airfield safety compliance. Include a requirement for routine inspections by the resident engineer (RE) and the construction contractors. If the engineering consultants and/or contractors have a Safety Officer who will conduct such inspections, identify this individual. Describe procedures for special inspections, such as those required to reopen areas for aircraft operations. Part 139 requires daily airfield inspections at certificated airports, but these may need to be more frequent when construction is in progress. Discuss the role of such inspections on areas under construction. Include a requirement to immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

316. Underground Utilities. Explain how existing underground utilities will be located and protected. Identify each utility owner and include contact information for each company/agency in the master list. Address emergency response procedures for damaged or disrupted utilities. Include a reference to paragraph 314 above for notification of utility owners of accidental utility disruption as required.

317. Penalties. Describe in this section specific penalties imposed for noncompliance with airport rules and regulations, including the CSPP: SIDA violations, Vehicle/Pedestrian Deviations (VPD), and others.

318. Special Conditions. Identify any special conditions that may trigger specific safety mitigation actions outlined in this CSPP: low visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, VPD, and other activities requiring construction suspension/resumption. Include a reference to paragraph 310 above for compliance with airport safety and security measures and for radio communications as required. Include a reference to paragraph 319 below for emergency notification of all involved parties, including police/security, ARFF, and medical services.

319. Runway and Taxiway Visual Aids. Include marking, lighting, signs, and visual NAVAIDS.

Detail temporary runway and taxiway marking, lighting, signs, and visual NAVAIDs required for the construction. Discuss existing marking, lighting, signs, and visual NAVAIDs that are temporarily, altered, obliterated, or shut down. Consider non-federal facilities and address requirements for reimbursable agreements necessary for alteration of FAA facilities and for necessary flight checks. Identify temporary TORA signs or runway distance remaining signs if appropriate. Identify required temporary visual NAVAIDs such as REIL or PAPI. Quote from, rather than incorporate by reference, AC 150/5340-1, Standards for Airport Markings, AC 150/5340-18, Standards for Airport Sign Systems, and AC 150/5340-30, as required. Attach drawings to graphically indicate proposed marking, lighting, signs, and visual NAVAIDs.

320. Marking and Signs for Access Routes. Detail plans for marking and signs for vehicle access routes. To the extent possible, signs should be in conformance with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications, not hand lettered. Detail any modifications to the guidance in the MUTCD necessary to meet frangibility/height requirements.

321. Hazard Marking and Lighting. Specify all marking and lighting equipment, including when and where each type of device is to be used. Specify maximum gaps between barricades and the maximum spacing of hazard lighting. Identify one individual and at least one alternate responsible for maintenance of hazard marking and lighting equipment in the master telephone list. Include a reference to paragraph 314 above. Attach drawings to graphically indicate the placement of hazard marking and lighting equipment.

322. Protection of Runway and Taxiway Safety Areas. This section should focus exclusively on procedures for protecting all safety areas, including those altered by the construction: methods of demarcation, limit of access, movement within safety areas, stockpiling and trenching restrictions, and so on. Reference AC 150/5300-13: Airport Design as required. Include a reference to paragraph 310 above for procedures regarding vehicle and personnel movement within safety areas. Include a reference to paragraph 310 above for material stockpile restrictions as required. Detail requirements for trenching, excavations, and backfill. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify open excavations as required. If runway and taxiway closures are proposed to protect safety areas, or if temporary displaced thresholds and/or revised declared distances are used to provide adequate Runway Safety Area, include a reference to paragraphs 314 and 319 above. Detail procedures for protecting the runway OFZ, runway OFA, taxiway OFA and runway approach surfaces including those altered by the construction: methods of demarcation, limit of cranes, storage of equipment, and so on. Quote from, rather than incorporate by reference, AC 150/5300-13: Airport Design as required. Include a reference to paragraph 323 for height (i.e. crane) restrictions as required. One way to address the height of equipment that will move during the project is to establish a three-dimensional “box” within which equipment will be confined that can be studied as a single object. Attach drawings to graphically indicate the safety area, OFZ, and OFA boundaries.

323. Other Limitations on Construction. This section should describe what limitations must be applied to each area of work and when each limitation will be applied: limitations due to airport operations, height (i.e. crane) restrictions, areas which cannot be worked at simultaneously, day/night work restrictions, winter construction, and other limitations. Include a reference to paragraph 307 above for project phasing requirements based on construction limitations as required.

Appendix 1. Related Reading Material

Obtain the latest version of the following free publications from the FAA on its Web site at <http://www.faa.gov/airports/>.

| AC | Title and Description |
|----------------|---|
| AC 150/5200-28 | Notices to Airmen (NOTAMs) for Airport Operators |
| | Guidance for using the NOTAM System in airport reporting. |
| AC 150/5200-30 | Airport Winter Safety and Operations |
| | Guidance for airport owners/operators on the development of an acceptable airport snow and ice control program and on appropriate field condition reporting procedures. |
| AC 150/5200-33 | Hazardous Wildlife Attractants On or Near Airports |
| | Guidance on locating certain land uses that might attract hazardous wildlife to public-use airports. |
| AC 150/5210-5 | Painting, Marking, and Lighting of Vehicles Used on an Airport. |
| | Guidance, specifications, and standards for painting, marking, and lighting vehicles operating in the airport air operations areas. |
| AC 150/5210-20 | Ground Vehicle Operations on Airports |
| | Guidance to airport operators on developing ground vehicle operation training programs. |
| AC 150/5300-13 | Airport Design |
| | FAA standards and recommendations for airport design, establishes approach visibility minimums as an airport design parameter, and contains the Object Free area and the obstacle free-zone criteria. |
| AC 150/5310-24 | Airport Foreign Object Debris Management |
| | Guidance for developing and managing an airport foreign object debris (FOD) program |
| AC 150/5220-4 | Water Supply Systems for Aircraft Fire and Rescue Protection. |
| | Guidance on selecting a water source and meeting standards for a distribution system to support aircraft rescue and fire fighting service operations on airports. |
| AC 150/5320-15 | Management of Airport Industrial Waste |
| | Basic information on the characteristics, management, and regulations of industrial wastes generated at airports. Guidance for developing a Storm Water Pollution Prevention Plan (SWPPP) that applies best management practices to eliminate, prevent, or reduce pollutants in storm water runoff with particular airport industrial activities. |
| AC 150/5340-1 | Standards for Airport Markings |
| | FAA standards for markings used on airport runways, taxiways, and aprons. |
| AC 150/5340-18 | Standards for Airport Sign Systems |
| | FAA standards for the siting and installation of signs on airport runways and taxiways. |
| AC 150/5345-28 | Precision Approach Path Indicator (PAPI) Systems |
| | FAA standards for PAPI systems, which provide pilots with visual glide slope guidance during approach for landing. |

| AC | Title and Description |
|---------------------|---|
| AC 150/5340-30 | Design and Installation Details for Airport Visual Aids |
| | Guidance and recommendations on the installation of airport visual aids. |
| AC 150/5345-39 | Specification for L-853, Runway and Taxiway Retroreflective Markers |
| AC 150/5345-44 | Specification for Runway and Taxiway Signs |
| | FAA specifications for unlighted and lighted signs for taxiways and runways. |
| AC 150/5345-53 | Airport Lighting Certification Program |
| | Details on the Airport Lighting Equipment Certification Program (ALECP). |
| AC 150/5345-50 | Specification for Portable Runway and Taxiway Lights |
| | FAA standards for portable runway and taxiway lights and runway end identifier lights for temporary use to permit continued aircraft operations while all or part of a runway lighting system is inoperative. |
| AC 150/5345-55 | Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure |
| AC 150/5370-10 | Standards for Specifying Construction of Airports |
| | Standards for construction of airports, including earthwork, drainage, paving, turfing, lighting, and incidental construction. |
| FAA Order 5200.11 | FAA Airports (ARP) Safety Management System (SMS) |
| | Basics for implementing SMS within ARP. Includes roles and responsibilities of ARP management and staff as well as other FAA lines of business that contribute to the ARP SMS. |
| FAA Certalert 98-05 | Grasses Attractive to Hazardous Wildlife |
| | Guidance on grass management and seed selection. |
| FAA Form 7460-1 | Notice of Proposed Construction or Alteration |
| FAA Form 7480-1 | Notice of Landing Area Proposal |

Obtain the latest version of the following free publications from the Electronic Code of Federal Regulations at <http://ecfr.gpoaccess.gov/>.

| | |
|------------------------|---------------------------|
| Title 14 CFR Part 139 | Certification of Airports |
| Title 49 CFR Part 1542 | Airport Security |

Obtain the latest version of the Manual on Uniform Traffic Control Devices from the Federal Highway Administration at <http://mutcd.fhwa.dot.gov/>.

Appendix 2. Definition of Terms

| Term | Definition |
|----------------------|--|
| 7460-1 | Notice Of Proposed Construction Or Alteration. For on-airport projects, the form submitted to the FAA regional or airports division office as formal written notification of any kind of construction or alteration of objects that affect navigable airspace, as defined in 14 CFR Part 77, safe, efficient use, and preservation of the navigable airspace. (See guidance available on the FAA web site at oeaaa.faa.gov .) The form may be downloaded at http://www.faa.gov/airports/resources/forms/ , or filed electronically at: https://oeaaa.faa.gov . |
| 7480-1 | Notice Of Landing Area Proposal. Form submitted to the FAA Airports Regional Division Office or Airports District Office as formal written notification whenever a project without an airport layout plan on file with the FAA involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport The form may be downloaded at http://www.faa.gov/airports/resources/forms/ . |
| AC | Advisory Circular |
| ACRC | Aircraft Reference Code |
| ACSI | Airport Certification Safety Inspector |
| ADG | Airplane Design Group |
| AIP | Airport Improvement Program |
| ALECP | Airport Lighting Equipment Certification Program |
| ANG | Air National Guard |
| AOA | Air Operations Area. Any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runways, taxiways, or aprons. |
| ARFF | Aircraft Rescue and Fire Fighting |
| ARP | FAA Office of Airports |
| ASDA | Accelerate-Stop Distance Available |
| ATCT | Airport Traffic Control Tower |
| ATIS | Automatic Terminal Information Service |
| ATO | Air Traffic Organization |
| Certificated Airport | An airport that has been issued an Airport Operating Certificate by the FAA under the authority of 14 CFR Part 139, Certification of Airports. |
| CFR | Code of Federal Regulations |
| Construction | The presence and movement of construction-related personnel, equipment, and materials in any location that could infringe upon the movement of aircraft. |
| CSPP | Construction Safety And Phasing Plan. The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications. |

| Term | Definition |
|----------------------|--|
| CTAF | Common Traffic Advisory Frequency |
| Displaced Threshold | A threshold that is located at a point on the runway other than the designated beginning of the runway. The portion of pavement behind a displaced threshold is available for takeoffs in either direction or landing from the opposite direction. |
| DOT | Department of Transportation |
| EPA | Environmental Protection Agency |
| FOD | Foreign Object Debris |
| HAZMAT | Hazardous Materials |
| IFR | Instrument Flight Rules |
| ILS | Instrument Landing System |
| LDA | Landing Distance Available |
| LOC | Localizer antenna array |
| Movement Area | The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading aprons and aircraft parking areas (reference 14 CFR Part 139). |
| MSDS | Material Safety Data Sheet |
| MUTCD | Manual on Uniform Traffic Control Devices |
| NAVAID | Navigation Aid |
| NAVAID Critical Area | An area of defined shape and size associated with a NAVAID that must remain clear and graded to avoid interference with the electronic signal. |
| Non-Movement Area | The area inside the airport security fence exclusive of the Movement Area. It is important to note that the non-movement area includes pavement traversed by aircraft. |
| NOTAM | Notices to Airmen |
| Obstruction | Any object/obstacle exceeding the obstruction standards specified by 14 CFR Part 77, subpart C. |
| OE / AAA | Obstruction Evaluation / Airport Airspace Analysis |
| OFA | Object Free Area. An area on the ground centered on the runway, taxiway, or taxi lane centerline provided to enhance safety of aircraft operations by having the area free of objects except for those objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. (See AC 150/5300-13, for additional guidance on OFA standards and wingtip clearance criteria.) |
| OFZ | Obstacle Free Zone. The airspace below 150 ft (45 m) above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway and for missed approaches. The OFZ is subdivided as follows: Runway OFZ, Inner Approach OFZ, Inner Transitional OFZ, and Precision OFZ. Refer to AC 150/5300-13 for guidance on OFZ. |
| OSHA | Occupational Safety and Health Administration |
| P&R | Planning and Requirements Group |

| Term | Definition |
|--------------------------|---|
| PAPI | Precision Approach Path Indicators |
| PFC | Passenger Facility Charge |
| PLASI | Pulse Light Approach Slope Indicators |
| Project Proposal Summary | A clear and concise description of the proposed project or change that is the object of Safety Risk Management. |
| RE | Resident Engineer |
| REIL | Runway End Identifier Lights |
| RNAV | Area Navigation |
| ROFA | Runway Object Free Area |
| RSA | Runway Safety Area. A 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, in accordance with AC 150/5300-13. |
| SIDA | Security Identification Display Area |
| SMS | Safety Management System |
| SPCD | Safety Plan Compliance Document. Details developed and submitted by a contractor to the airport operator for approval providing details on how the performance of a construction project will comply with the CSPP. |
| SRM | Safety Risk Management |
| Taxiway Safety Area | A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway, in accordance with AC 150/5300-13. |
| TDG | Taxiway Design Group |
| Temporary | Any condition that is not intended to be permanent. |
| Temporary Runway End | The beginning of that portion of the runway available for landing and taking off in one direction, and for landing in the other direction. Note the difference from a displaced threshold. |
| Threshold | The beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced. |
| TODA | Takeoff Distance Available |
| TOFA | Taxiway Object Free Area |
| TORA | Takeoff Run Available. The length of the runway less any length of runway unavailable and/or unsuitable for takeoff run computations. See AC 150/5300-13 for guidance on declared distances. |
| TSA | Taxiway Safety Area Transportation Security Administration |
| UNICOM | A radio communications system of a type used at small airports. |
| VASI | Visual Approach Slope Indicators |

| Term | Definition |
|-------------|---|
| VGSI | Visual Glide Slope Indicator. A device that provides a visual glide slope indicator to landing pilots. These systems include precision approach path indicators (PAPI), visual approach slope indicators (VASI), and pulse light approach slope indicators (PLASI). |
| VFR | Visual Flight Rules |
| VOR | VHF Omnidirectional Radio Range |
| VPD | Vehicle / Pedestrian Deviation |

Appendix 3. Safety and Phasing Plan Checklist

This appendix is keyed to Section 2. Plan Requirements. In the electronic version of this AC, clicking on the paragraph designation in the Reference column will access the applicable paragraph. There may be instances where the CSPP requires provisions that are not covered by the list in this appendix.

This checklist is intended as an aid, not as a required submittal.

| Coordination | Reference | Addressed | | | Remarks |
|---|-----------|---------------------------------|--------------------------------|--------------------------------|---------|
| General Considerations | | | | | |
| Requirements for predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction are specified. | 205 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Operational safety is a standing agenda item for construction progress meetings. | 205 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Scheduling of the construction phases is properly addressed. | 206 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Areas and Operations Affected by Construction Activity | | | | | |
| Drawings showing affected areas are included. | 207.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Closed or partially closed runways, taxiways, and aprons are depicted on drawings. | 207.a(1) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Access routes used by ARFF vehicles affected by the project are addressed. | 207.a(2) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Access routes used by airport and airline support vehicles affected by the project are addressed. | 207.a(3) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Underground utilities, including water supplies for fire fighting and drainage. | 207.a(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Approach/departure surfaces affected by heights of temporary objects are addressed. | 207.a(5) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads are properly depicted on drawings. | 207.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Temporary changes to taxi operations are addressed. | 207.b(1) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

| Coordination | Reference | Addressed | | | Remarks |
|---|--------------------------------|---------------------------------|--------------------------------|--------------------------------|---------|
| Detours for ARFF and other airport vehicles are identified. | 207.b(2) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Maintenance of essential utilities and underground infrastructure is addressed. | 207.b(3) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Temporary changes to air traffic control procedures are addressed. | 207.b(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| NAVAIDS | | | | | |
| Critical areas for NAVAIDS are depicted on drawings. | 208 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Effects of construction activity on the performance of NAVAIDS, including unanticipated power outages, are addressed. | 208 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Protection of NAVAID facilities is addressed. | 208 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The required distance and direction from each NAVAID to any construction activity is depicted on drawings. | 208 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Procedures for coordination with FAA ATO/Technical Operations, including identification of points of contact, are included. | 208, 213.a, 213.e(3)(a), 218.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Contractor Access | | | | | |
| The CSPP addresses areas to which contractor will have access and how the areas will be accessed. | 209 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The application of 49 CFR Part 1542 Airport Security, where appropriate, is addressed. | 209 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The location of stockpiled construction materials is depicted on drawings. | 209.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The requirement for stockpiles in the ROFA to be approved by FAA is included. | 209.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Requirements for proper stockpiling of materials are included. | 209.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

| Coordination | Reference | Addressed | | | Remarks |
|---|-----------------------|---------------------------------|--------------------------------|--------------------------------|---------|
| Construction site parking is addressed. | 209.b(1) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Construction equipment parking is addressed. | 209.b(2) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Access and haul roads are addressed. | 209.b(3) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| A requirement for marking and lighting of vehicles to comply with AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport, is included. | 209.b(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Proper vehicle operations, including requirements for escorts, are described. | 209.b(5), 209.b(6) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Training requirements for vehicle drivers are addressed. | 209.b(7) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Two-way radio communications procedures are described. | 209.b(9) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Maintenance of the secured area of the airport is addressed. | 209.b(10) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Wildlife Management | | | | | |
| The airport operator's wildlife management procedures are addressed. | 210 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Foreign Object Debris Management | | | | | |
| The airport operator's FOD management procedures are addressed. | 211 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Hazardous Materials Management | | | | | |
| The airport operator's hazardous materials management procedures are addressed. | 212 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Notification of Construction Activities | | | | | |
| Procedures for the immediate notification of airport user and local FAA of any conditions adversely affecting the operational safety of the airport are detailed. | 213 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

| Coordination | Reference | Addressed | | | Remarks |
|--|-------------------------|---------------------------------|--------------------------------|--------------------------------|---------|
| Maintenance of a list by the airport operator of the responsible representatives/points of contact for all involved parties and procedures for contacting them 24 hours a day, seven days a week is specified. | 213.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| A list of local ATO/Technical Operations personnel is included. | 213.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| A list of ATCT managers on duty is included. | 213.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| A list of authorized representatives to the OCC is included. | 213.b | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Procedures for coordinating, issuing, maintaining and cancelling by the airport operator of NOTAMS about airport conditions resulting from construction are included. | 208, 213.b, 218.b(4)(i) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Provision of information on closed or hazardous conditions on airport movement areas by the airport operator to the OCC is specified. | 213.b | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Emergency notification procedures for medical, fire fighting, and police response are addressed. | 213.c | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Coordination with ARFF personnel for non-emergency issues is addressed. | 213.d | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Notification to the FAA under 14 CFR parts 77 and 157 is addressed. | 213.e | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Reimbursable agreements for flight checks and/or design and construction for FAA owned NAVAIDs are addressed. | 213.e(3)(b) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Inspection Requirements | | | | | |
| Daily inspections by both the airport operator and contractor are specified. | 214.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Final inspections at certificated airports are specified when required. | 214.b | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Underground Utilities | | | | | |
| Procedures for protecting existing underground facilities in excavation areas are described. | 215 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

| Coordination | Reference | Addressed | | | Remarks |
|---|-----------------------------|---------------------------------|--------------------------------|--------------------------------|---------|
| Penalties | | | | | |
| Penalty provisions for noncompliance with airport rules and regulations and the safety plans are detailed. | 216 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Special Conditions | | | | | |
| Any special conditions that affect the operation of the airport or require the activation of any special procedures are addressed. | 217 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Runway and Taxiway Visual Aids - Marking, Lighting, Signs, and Visual NAVAIDs | | | | | |
| The proper securing of temporary airport markings, lighting, signs, and visual NAVAIDs is addressed. | 218.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Frangibility of airport markings, lighting, signs, and visual NAVAIDs is specified. | 218.a, 218.c, 219, 220.b(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The requirement for markings to be in compliance with AC 150/5340-1, Standards for Airport Markings is specified. | 218.b | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The requirement for lighting to conform to AC 150/5340-30, Design and Installation Details for Airport Visual Aids, AC 150/5345-50, Specification for Portable Runway and Taxiway Lights , and AC 150/5345-53 Airport Lighting Certification Program, is specified. | 218.b(1)(f) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The use of a lighted X is specified where appropriate. | 218.b(1)(b), 218.b(3) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The requirement for signs to conform to AC 150/5345-44, Specification for Runway and Taxiway Signs, AC 50/5340-18, Standards for Airport Sign Systems, and AC 150/5345-53, Airport Lighting Certification Program, is specified. | 218.c | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Marking and Signs For Access Routes | | | | | |
| The CSPP specifies that pavement markings and signs intended for construction personnel should conform to AC 150/5340-18 and, to the extent practicable, with the MUTCD and/or State highway specifications. | 219 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Hazard Marking and Lighting | | | | | |
| Prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles are specified. | 220.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

| Coordination | Reference | Addressed | | | Remarks |
|--|-----------------------|---------------------------------|--------------------------------|--------------------------------|---------|
| Hazard marking and lighting are specified to identify open manholes, small areas under repair, stockpiled material, and waste areas. | 220.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP considers less obvious construction-related hazards. | 220.a | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast is specified. | 220.b(1) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The spacing of barricades is specified such that a breach is physically prevented barring a deliberate act. | 220.b(1) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Red lights meeting the luminance requirements of the State Highway Department are specified. | 220.b(2) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Barricades, temporary markers, and other objects placed and left in areas adjacent to any open runway, taxiway, taxi lane, or apron are specified to be as low as possible to the ground, and no more than 18 in high. | 220.b(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Barricades marked with diagonal, alternating orange and white stripes are specified to indicate construction locations in which no part of an aircraft may enter. | 220.b(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Highly reflective barriers with lights are specified to barricade taxiways leading to closed runways. | 220.b(5) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Markings for temporary closures are specified. | 220.b(5) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The provision of a contractor's representative on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades is specified. | 220.b(7) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Protection of Runway and Taxiway Safety Areas | | | | | |
| The CSPP clearly states that no construction may occur within a safety area while the associated runway or taxiway is open for aircraft operations. | 221.a(1), 221.c(1) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP specifies that the airport operator coordinates the adjustment of RSA or TSA dimensions with the ATCT and the appropriate FAA Airports Regional or District Office and issues a local NOTAM. | 221.a(2), 221.c(2) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

| Coordination | Reference | Addressed | | | Remarks |
|--|-----------|---------------------------------|--------------------------------|--------------------------------|---------|
| Procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations, are detailed. | 221.c(3) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP specifies that open trenches or excavations are not permitted within a safety area while the associated runway or taxiway is open. | 221.a(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Appropriate covering of excavations in the RSA or TSA that cannot be backfilled before the associated runway or taxiway is open is detailed. | 221.a(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP includes provisions for prominent marking of open trenches and excavations at the construction site. | 221.a(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Grading and soil erosion control to maintain RSA/TSA standards are addressed. | 221.c(5) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP specifies that equipment is to be removed from the ROFA when not in use. | 221.b | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP clearly states that no construction may occur within a taxiway safety area while the taxiway is open for aircraft operations. | 221.c | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Appropriate details are specified for any construction work to be accomplished in a taxiway object free area. | 221.d | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Measures to ensure that personnel, material, and/or equipment do not penetrate the OFZ or threshold siting surfaces while the runway is open for aircraft operations are included. | 221.e | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Provisions for protection of runway approach/departure areas and clearways are included. | 221.f | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| Other Limitations on Construction | | | | | |
| The CSPP prohibits the use of open flame welding or torches unless adequate fire safety precautions are provided and the airport operator has approved their use. | 222.a(2) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP prohibits the use of flare pots within the AOA at any time. | 222.a(4) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |
| The CSPP prohibits the use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property. | 222.a(3) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA | |

Appendix 4. 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 contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project.

Potentially Hazardous Conditions

| Item | Action Required | or | None |
|--|-----------------|----|--------------------------|
| Excavation adjacent to runways, taxiways, and aprons improperly backfilled. | | | <input type="checkbox"/> |
| Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking. | | | <input type="checkbox"/> |
| Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends. | | | <input type="checkbox"/> |
| Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ. | | | <input type="checkbox"/> |
| 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. | | | <input type="checkbox"/> |
| 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. | | | <input type="checkbox"/> |
| Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area. | | | <input type="checkbox"/> |
| Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, 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. | | | <input type="checkbox"/> |

| Item | Action Required | or | None |
|---|-----------------|----|--------------------------|
| 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. | | | <input type="checkbox"/> |
| 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. | | | <input type="checkbox"/> |
| Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports. | | | <input type="checkbox"/> |
| Obliterated or faded temporary markings on active operational areas. | | | <input type="checkbox"/> |
| Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards. | | | <input type="checkbox"/> |
| Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions. | | | <input type="checkbox"/> |
| 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. | | | <input type="checkbox"/> |
| Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings. | | | <input type="checkbox"/> |
| Lack of radio communications with construction vehicles in airport movement areas. | | | <input type="checkbox"/> |
| 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 aircraft operations. | | | <input type="checkbox"/> |
| 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. | | | <input type="checkbox"/> |
| Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways. | | | <input type="checkbox"/> |

| Item | Action Required | or | None |
|--|-----------------|----|--------------------------|
| Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system). | | | <input type="checkbox"/> |
| Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits. | | | <input type="checkbox"/> |
| Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf. | | | <input type="checkbox"/> |
| Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it. | | | <input type="checkbox"/> |
| Site burning, which can cause possible obscuration. | | | <input type="checkbox"/> |
| Construction work taking place outside of designated work areas and out of phase. | | | <input type="checkbox"/> |

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